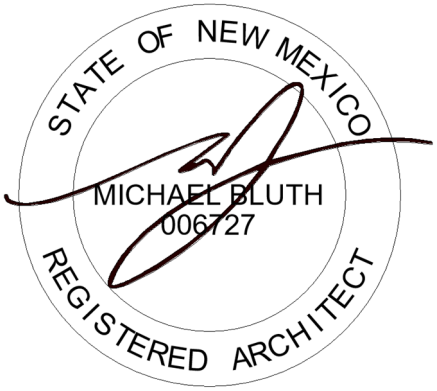
PROJECT MANUAL

SENMC
TRADES X TECHNOLOGIES VOCATIONAL BUILDING

SOUTHEAST NEW MEXICO COLLEGE
1500 E. UNIVERSITY DR.
CARLSBAD, NM 88220



NINE DEGREES ARCHITECTURE + DESIGN, INC.

Construction Documents
April 2025

SENMC TRADES X TECHNOLOGIES VOCATIONAL BUILDING

INDEX TO DRAWINGS

GENERAL

G001 – COVER SHEET
G002 – PROJECT INFORMATION
G003 – CODE REVIEW DATA/EXITING PLAN
G004 – STANDARD ACCESSIBLE DETAILS & WALL TYPES

CIVIL

C100 – VICINITY MAP, F.I.R.M., LEGEND AND GENERAL NOTES
CP101 – CIVIL PAVING PLAN
CP501 – PAVEMENT, SECTION AND DETAILS
CG101 – CIVIL GRADING PLAN
CG501 – STORM DRAIN DETAILS
CG502 – STORM DRAIN DETAILS
CU101 – CIVIL UTILITY PLAN
CU501 – WATER AND SEWER DETAILS

RETAINING WALL

RW100 – STRUCTURAL NOTES
RW200 – STRUCTURAL WALL ELEVATIONS AND DETAILS
RW201 – RETAINING WALL SECTIONS

LANDSCAPE

LP-101 – PLANTING PLAN
LP-102 – PLANTING PLAN
LI101 – IRRIGATION PLAN
LI102 – IRRIGATION PLAN
LI501 – IRRIGATION DETAILS

STRUCTURAL

S000 – STRUCTURAL GENERAL NOTES
S001 – SPECIAL INSPECTIONS TABLES
S002 – SPECIAL INSPECTIONS TABLES
S003 – STRUCTURE ISOMETRIC VIEWS 1 OF 2
S004 – STRUCTURE ISOMETRIC VIEWS 2 OF 2
S100 – OVERALL FOUNDATION PLAN
S100A – ENLARGED FOUNDATION PLAN – AREA A
S100B – ENLARGED FOUNDATION PLAN – AREA B
S100C – ENLARGED FOUNDATION PLAN – AREA C
S100D – ENLARGED FOUNDATION PLAN – AREA D
S101 – OVERALL SECOND FLOOR FRAMING PLAN
S101A – ENLARGED SECOND FLOOR FRAMING PLAN – AREA A
S101B – ENLARGED SECOND FLOOR FRAMING PLAN – AREA B
S101C – ENLARGED SECOND FLOOR FRAMING PLAN – AREA C
S101D – ENLARGED SECOND FLOOR FRAMING PLAN – AREA D
S102 – OVERALL ROOF FRAMING PLAN
S102A –ENLARGED ROOF FRAMING PLAN – AREA A

S102B – ENLARGED ROOF FRAMING PLAN – AREA B
S102C – ENLARGED ROOF FRAMING PLAN – AREA C
S102D – ENLARGED ROOF FRAMING PLAN – AREA D
S102E – ROOF JOIST LOADING DIAGRAMS
S103.1 – ENLARGED STAIR FRAMING PLANS
S103.2 – ENLARGED STAIR FRAMING PLANS
S200 - VERTICAL BRACE ELEVATIONS
S300 – WALL SECTIONS 1
S301 – WALL SECTIONS 2
S302 – WALL SECTIONS 3
S303 – WALL SECTIONS 4
S304 – WALL SECTIONS 5
S305 – ELEVATOR SECTIONS
S500 – TYPICAL CONCRETE DETAILS
S501 – CONCRETE SECTIONS
S520 – TYPICAL STEEL DETAILS 1 OF 2
S521 – TYPICAL STEEL DETAILS 2 OF 2
S522 – STEEL DETAILS
S523 – STEEL DETAILS
S530 – TYPICAL COLD FORM DETAILS
S540 – MASONRY DETAILS
S700 – STRUCTURAL SCHEDULES

ARCHITECTURAL

A100 – ARCHITECTURAL SITE PLAN
A101 – OVERALL ORIENTATION PLAN - FIRST FLOOR
A101.1 – ENLARGED FIRST FLOOR PLAN AREA A
A101.2 – ENLARGED FIRST FLOOR PLAN AREA B
A101.3 – ENLARGED FIRST FLOOR PLAN AREA C
A101.4 – ENLARGED FIRST FLOOR PLAN AREA D
A102 – OVERALL ORIENTATION PLAN – SECOND FLOOR
A102.1 – ENLARGED SECOND FLOOR PLAN AREA E
A102.2 – ENLARGED SECOND FLOOR PLAN AREA F
A102.3 – ENLARGED SECOND FLOOR PLAN AREA G
A102.4 – ENLARGED SECOND FLOOR PLAN AREA H
A111 – FIRST FLOOR DIMENSION AND PARTITION PLAN
A112 – SECOND FLOOR DIMENSION AND PARTITION PLAN
A121 - OVERALL FIRST FLOOR REFLECTED CEILING PLAN
A121.1 – ENLARGED FIRST FLOOR REFLECTED CEILING PLAN AREA A
A121.2 – ENLARGED FIRST FLOOR REFLECTED CEILING PLAN AREA B
A121.3 – ENLARGED FIRST FLOOR REFLECTED CEILING PLAN AREA C
A121.4 – ENLARGED FIRST FLOOR REFLECTED CEILING PLAN AREA D
A122 – OVERALL SECOND FLOOR REFLECTED CEILING PLAN
A122.1 – ENLARGED SECOND FLOOR REFLECTED CEILING PLAN AREA E
A122.2 – ENLARGED SECOND FLOOR REFLECTED CEILING PLAN AREA F
A122.3 – ENLARGED SECOND FLOOR REFLECTED CEILING PLAN AREA G
A122.4 – ENLARGED SECOND FLOOR REFLECTED CEILING PLAN AREA H
A131 – OVERALL ROOF PLAN & ROOF DETAILS
A201 – EXTERIOR ELEVATIONS
A202 – EXTERIOR ELEVATIONS
A301 – BUILDING SECTIONS & DETAILS
A302 – BUILDING SECTIONS & DETAILS

A310 – WALL SECTIONS
A311 – WALL SECTIONS
A312 - WALL SECTIONS
A313 – WALL SECTIONS
A401 – ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS
A402 – ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS
A403 – FIRST FLOOR TYPICAL INTERIOR ELEVATIONS
A404 – FIRST FLOOR TYPICAL INTERIOR ELEVATIONS
A405 – ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS
A406 – SECOND FLOOR TYPICAL INTERIOR ELEVATIONS
A407 – SECOND FLOOR ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS
A408 – SECOND FLOOR ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS
A409 – ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS
A410 – ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS
A501 – SITE PLAN DETAILS
A502 – SITE PLAN DETAILS
A503 – SITE PLAN DETAILS
A510 – DETAILS
A511 – DETAILS
A512 – FLOOR PLAN DETAILS
A513 – FLOOR PLAN DETAILS
A514 – FLOOR PLAN DETAILS
A515 – FLOOR PLAN DETAILS
A516 – FLOOR PLAN DETAILS
A517 – ENVELOPE DETAILS
A518 – ROOFING DETAILS
A530 – ALUMINUM DETAILS
A531 – DOORS & WINDOWS
A601 – SCHEDULES
A602 – DOOR TYPES
A603 – WINDOW TYPES
A604 – WINDOW TYPES
A651 – FLOOR FINISH PLAN – FIRST FLOOR
A652 – FLOOR FINISH PLAN – SECOND FLOOR
A653 – WALL COVERING PLAN – FIRST FLOOR
A654 – WALL COVERING PLAN – SECOND FLOOR
A655 – FFE – FIRST FLOOR
A656 – FFE – SECOND FLOOR

MECHANICAL

M101 – MECHANICAL PLAN – FIRST FLOOR
M102 – MECHANICAL PLAN – SECOND FLOOR
M103 – MECHANICAL PIPING PLAN – FIRST FLOOR
M104 – MECHANICAL PIPING PLAN – SECOND FLOOR
M105 – MECHANICAL PLAN – ROOF
M401 - MECHANICAL ENLARGED PLANS
M402 – MECHANICAL ENLARGED PLANS
M501 - MECHANICAL DETAILS
M502 – MECHANICAL DETAILS
M503 – MECHANICAL DETAILS
M601 – MECHANICAL GENERAL NOTES, LEGEND AND SCHEDULES

M602 – MECHANICAL SCHEDULES
M603 – MECHANICAL SCHEDULES
M701 – MECHANICAL CONTROLS
M702 – MECHANICAL CONTROLS
M703 – MECHANICAL CONTROLS

PLUMBING

PS101 – PLUMBING SITE PLAN
P101 – WASTE AND VENT PIPING PLAN – FIRST PLAN
P102 – WASTE AND VENT PIPING PLAN – SENCOND PLAN
P103 – DOMESTIC WATER, GAS & SPECIAL PIPING PLAN – FISRT FLOOR
P104 – DOMESTIC WATER, GAS & SPECIAL PIPING PLAN – SECOND PLAN
P105 – PLUMBING PIPING PLAN – ROOF
P401 – WASTE AND VENT PIPING ENLARGED PLANS
P402 – DOMESTIC WATER PIPING ENLARGED PLANS
P501 – PLUMBING DETAILS
P502 – PLUMBING DETAILS
P601 – PLUMBING GENERAL NOTES, LEGEND AND SCHEDULES
P602 – PLUMBING SCHEDULES

ELECTRICAL

E001 – ELECTRICAL LEGEND NOTES & FIXTURE SCHEDULES
ES101 – ELECTRICAL SITE PLAN
E101 - LIGHTING PLAN – FIRST FLOOR
E102 - LIGHTING PLAN – SECOND FLOOR
E201 – POWER PLAN – FIRST FLOOR
E202 – POWER PLAN – SECOND FLOOR
E203 – POWER & SPECIAL SYSTEMS DETAILS
E301 – MECHANICAL CONNECTIONS PLAN – FIRST FLOOR
E302 – MECHANICAL CONNECTIONS PLAN – SECOND FLOOR
E303 – MECHANICAL CONNECTIONS PLAN – ROOF
E401 – FIRE ALARM PLAN – FIRST FLOOR
E402 – FIRE ALARM PLAN – SECOND FLOOR
E501 – SPECIAL SYSTEMS TECHNOLOGY PLAN - FIRST FLOOR
E502 – SPECIAL SYSTEM TECHNOLOGY PLAN – SECOND FLOOR
E503 – SPECIAL SYSTEM TECHNOLOGY DETAILS
E601 – ELECTRICAL RISER DIAGRAM & DETAILS
E602 – ELECTRICAL PANEL SCHEDULES

FIRE PROTECTION

FP101 – FIRE PROTECTION PLAN – FIRST FLOOR
FP102 – FIRE PROTECTION PLAN – SECOND PLAN

END OF DRAWING INDEX

INDEX TO DRAWINGS

SECTION 000110
TABLE OF CONTENTS

INDEX TO DRAWINGS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

PROCUREMENT REQUIREMENTS

BID DOCUMENTS BY SENMC (BOILERPLATE)

CONTRACT FORMS

CONTRACT FORMS BY SENMC (BOILERPLATE)

CONTRACT CONDITIONS

CONTRACT FORMS BY SENMC (BOILERPLATE)

GEOTECHNICAL DATA

Document 00 31 32 - Geotechnical Data

TECHNICAL SPECIFICATIONS

DIVISION 01 - GENERAL REQUIREMENTS

Section 01 11 00 – Summary of Work
01 21 00 – Allowances
01 23 05 – Bid Lots
01 25 00 – Substitution Procedures
01 29 00 – Payment Procedures
01 31 00 – Project Management and Coordination
01 31 19 – Project Meetings
01 31 19.13 – Preconstruction Meetings
01 32 16 – Construction Progress Schedules
01 33 23 – Shop Drawings, Product Data, and Samples
01 41 00 – Regulatory Requirements
01 42 00 – References
01 42 16 – Definitions
01 45 00 – Quality Control
01 45 23 – Testing and Inspection Services
01 50 00 – Temporary Facilities and Controls
01 62 00 – Product Options
01 65 00 – Product Delivery Requirements
01 66 00 –- Product Storage and Handling Requirements
01 73 29 – Cutting and Patching
01 74 13 – Cleaning
01 74 19 – Construction Waste Management and Disposal
01 77 00 – Closeout Procedures
01 78 23 – Operation and Maintenance Data

01 78 30 – Warranties and Bonds
01 78 39 – Project Record Documents
01 78 40 – Spare Parts, Overages and Maintenance Materials
01 81 13 – Sustainable Design Requirements LEED v4 BD+C New Construction & Major Renovations
01 91 19 – Building Envelope Commissioning

DIVISION 03 - CONCRETE

Section 03 10 00 – Concrete Forming and Accessories
03 10 05 – Concrete Forming and Accessories (Retaining Wall)
03 20 00 – Concrete Reinforcing
03 20 05 – Concrete Reinforcing (Retaining Wall)
03 30 00 – Cast In Place Concrete
03 30 05 – Cast-In-Place Concrete (Retaining Wall)
03 35 43 – Polished Concrete Finishing
03 39 05 – Concrete Curing (Retaining Wall)

DIVISION 04 - MASONRY

Section 04 20 00 – Unit Masonry
04 73 25 – Adhered Stone Masonry over MVES

DIVISION 05 - METALS

Section 05 12 00 – Structural Steel Framing
05 21 00 – Steel Joists Framing
05 31 00 – Metal Roof Deck
05 40 00 – Cold-formed Metal Framing
05 50 00 – Metal Fabrications
05 51 13 – Metal Pan Stairs
05 73 00 – Ornamental Railings (Aluminum Cable)

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

Section 06 10 00 – Rough Carpentry
06 10 53 – Miscellaneous Carpentry
06 40 00 – Architectural Woodwork
06 71 13 – Composite Lumber

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

Section 07 05 23 – Air Barrier Performance Testing
07 05 43 – Cladding Support Systems
07 11 13 – Bituminous Dampproofing
07 14 00 – Fluid-applied Waterproofing
07 18 13 – Pedestrian Traffic Coating
07 21 00 – Building Insulation
07 22 16 – Roof and Deck Insulation
07 24 19 – Exterior Insulation and Finish System (EIFS) & Details
07 24 19.1 – Masonry Veneer Engineered System (MVES) & Details
07 26 00 – Vapor Retarders
07 27 00 – Air Barrier
07 42 00 – Aluminum Composite Metal Panels
07 42 13 – Metal Wall Panels

07 54 23 – Thermoplastic Single-Ply Roofing
07 62 00 – Sheet Metal and Miscellaneous Accessories
07 72 33 – Roof Hatches
07 81 16 – Cementitious Fireproofing
07 81 23 – Intumescent Fireproofing
07 84 00 – Firestopping
07 92 00 – Joint Sealants
07 95 13 – Expansion Joint Cover Assemblies

DIVISION 08 – OPENINGS

Section 08 11 00 – Hollow Metal Doors and Frames
08 14 23 – Plastic-Laminate-Faced Wood Doors
08 31 00 – Access Doors
08 33 10 – Rolling Fire Doors
08 33 23 – Overhead Coiling Doors
08 41 13 – Aluminum-Framed Entrances and Storefronts
08 44 13 – Glazed Aluminum Curtain Walls
08 62 50 – Tubular Daylighting Devices
08 63 00 – Skylight Systems (Walkable)
08 71 00 – Door Hardware
08 80 00 – Solar Control Insulating Low-E Coated Glass
08 81 00 – Fire Rated and Safety Glazing

DIVISION 09 - FINISHES

Section 09 22 16 – Non-Structural Metal Framing
09 29 00 – Gypsum Board
09 30 00 – Tiling
09 51 13 – Acoustical Panel Ceilings
09 62 83 – Glass Flooring Systems
09 65 13 – Resilient Stair Treads and Accessories
09 65 19 – Resilient Tile Flooring
09 68 13 – Modular Flooring for Commercial Applications
09 72 16 – Vinyl Wall Coverings
09 77 00 – Dry Erase Wall Covering
09 80 00 – Acoustical Systems Wall Panel System
09 84 13 – Acoustical Wall Panels
09 91 13 – Exterior Low VOC Paints and Coatings
09 91 23 – Interior Paints and Coatings

DIVISION 10 – SPECIALTIES

Section 10 11 16 – Markerboards and Tackboards
10 12 00 – Display Cases
10 14 00 – Identifying Devices
10 21 13 – Metal Toilet Compartments
10 22 39 – Folding Panel Partitions
10 22 39.13 – Folding Glass-panel Partitions
10 26 13 – Corner Guards
10 28 00 – Toilet Accessories
10 28 01 – Waste & Recycling Receptacles
10 44 13 – Fire Extinguishers and Cabinets
10 51 00 – Lockers

10 71 13 – Exterior Sun Control Devices
10 99 00 – Miscellaneous Specialties

DIVISION 11 – EQUIPMENT

Section 11 52 13 – Projection Screens
11 53 13 – Laboratory Fume Hoods (see section 12 35 53.13 – Metal Laboratory)

DIVISION 12 – FURNISHINGS

Section 12 00 00 – Furniture (Separate Price)
12 21 13 – Horizontal Blinds
12 24 13 – Roller Window Shades
12 32 16 – Manufactured Plastic-Laminate-Clad Casework
12 35 10.33 – Laboratory Service Carriers
12 35 53.13 – Metal Laboratory Casework
12 48 13 – Entrance Floor Mats
12 93 00 – Site Furnishings

DIVISION 14 - CONVEYING EQUIPMENT

Section 14 21 23.16 – Machine Room Less Traction Passenger Elevators
14 24 00 – Machine Room Less Hydraulic Elevators

DIVISION 21 - FIRE SUPPRESSION

Section 210000 – Fire Suppression Index
210500 – General Fire Suppression Requirements
211300 – Automatic Sprinkler Systems

DIVISION 22 - PLUMBING

Section 220000 – Plumbing Index
220500 – General Plumbing Requirements
230513 – Common Motor Requirements for Plumbing Equipment
220523 – Valves
220700 – Piping Insulation
220800 – Commissioning of Plumbing Systems
221000 – Pipe and Pipe Fittings
221113 – Domestic Water Systems
221123 – Natural Gas Piping Systems
221313 – Soil and Waste Piping Systems
221413 – Roof Drainage Systems
221500 – Compressed Air Piping Systems
224200 – Plumbing Fixtures
226600 – Acid Waste and Vent

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

Section 230000 – Heating, Ventilating, and Air Conditioning Index
230100 – Demonstration and Training
230500 – General Heating, Ventilating, and Air Conditioning Requirements

230513 – Common Motor Requirements for HVAC Equipment
230519 – Piping Specialties
230548 – Vibration Isolation and Expansion Compensation
230593 – Balancing of Mechanical Systems
230713 – Duct Insulation
230800 – Commissioning of HVAC Systems
232113 – Hydronic Piping Systems
232500 – Water Treatment Systems
233000 – Air Distribution
233513 – Dust Collection Systems

DIVISION 25 – INTEGRATED AUTOMATION

Section 250000 – Integrated Automation Index
250500 – General Integrated Automation Requirements
250900 – Mechanical System Instrumentation and Control
251100 – Electrical Controls and Interlocks
253000 – Controls and Instrumentation
256000 – Mechanical and Electrical Coordination Schedule

DIVISION 26 - ELECTRICAL

Section 260000 – Electrical Index
260500 – General Electrical Provisions
260519 – Low Voltage Conductors
260526 – Grounding
260533 – Raceways, Boxes, and Fittings
260536 – Cable Tray
260553 – Identification for Electrical Systems
260573 – Short Circuit Coordination Study – Arc Flash Risk Assessment
260800 – Commissioning of Electrical Systems
260933 – Dimming System
262200 – Low Voltage Transformers
262413 – Switchboards
262416 – Panelboards
262716 – Cabinets
262726 – Wiring Devices and Plates
262800 – Motor and Circuit Disconnects
262813 – Fuses
264300 – Surge Suppression Protection Devices
265119 – LED Interior Lighting
266000 – Mechanical and Electrical Coordination Schedule

DIVISION 27 - COMMUNICATIONS

Section 270000 – Communications Index
270500 – Common Work Results for Communications
270526 – Grounding and Bonding for Communication Systems
270528.2 – Pathways
270543 – Underground Duct and Raceways
270553 – Identification for Communication Systems
270800 – Commissioning and Acceptance

271005 – Structured Cabling for Voice and Data – Inside-Plant
271116 – Cabinets, Racks, Frames, and Enclosures
271119 – Termination Blocks and Patch Panels
271313 – Copper Cable Splicing and Outside Protected Terminations
271323 – Fiber Optic Backbone Cabling
271413 – Copper Riser and Intrabuilding Cabling
271523.2 – Fiber Optic Horizontal Cabling
271543 – Faceplates and Connectors

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

Section 280000 – Electrical Safety and Security Index
280500 – General Electrical Safety and Security Provisions
283000 – Fire Alarm Systems

DIVISION 31 – EARTHWORK

Section 312303 – Building Pad Preparation
310513 – Soils for Earthwork (Retaining Wall)
312316 – Excavation (Retaining Wall)
312323.1 – Fill (Retaining Wall)

DIVISION 32 - EXTERIOR IMPROVEMENTS

Section 32 17 26 – Tactile Warning Surfacing
32 24 23 – Irrigation System
32 92 00 – Planting
32 92 19 - Seeding

DIVISION 33 - UTILITIES

Refer to Civil Sheets

DIVISION 40 – PROCESS INTEGRATION

Section 400000 – Process Integration Index
400504 – Process Piping

SENMC TRADES x TECHNOLOGIES VOCATIONAL BUILDING

NAMES AND ADDRESSES

PROJECT NAME/ADDRESS:

SOUTHEAST NEW MEXICO COLLEGE
TRADES X TECHNOLOGIES VOCATIONAL BUILDING
1500 UNIVERSITY DR.
CARLSBAD, NM 88220

PRESIDENT: DR. KEVIN BEARDMORE

ARCHITECT:

NINE DEGREES ARCHITECTURE + DESIGN, INC.
101 MAGUEY CT. SUITE 2
SUNLAND PARK, NEW MEXICO 88063
P. 915-533-8482 F. 915-533-3282

PRINCIPAL ARCHITECT: CESAR MOLINA, AIA
ASSOCIATE ARCHITECT | PM: MICHAEL BLUTH, AIA

STRUCTUAL ENGINEER:

BOHANNAN HUSTON, INC.
425 S. TELSHOR BLVD C103
LAS CRUCES, NM 88011

CONTACT: MATTHEW BEAN, PE: 575.532.8670

STRUCTURAL ENGINEER (RETAINING WALL):

HARDER STRUCTURAL
108 S. STANTON ST.
EL PASO, TX. 79901

CONTACT: ISAAC HARDER, PE | 915.787.0622

MECHANICAL, ELECTRICAL AND PLUMBING ENGINEER:

TESTUDO ENGINEERING
7007 WYOMING BLVD NE STE. E
ALBUQUERQUE, NM 87109

CONTACT: WAYNE YEVOLI, PE | 505.554.1282

CIVIL ENGINEER:

HIGH MESA CONSULTING GROUP
6010 MIDWAY PARK BLVD, NE STE B
ALBUQUERQUE, NM 87109
CONTACT: GREAME MEANS, P.E. | 505.345.4250

LANDSCAPE:

CONCENSUS PLANNING
302 8TH ST NW
ALBUQUERQUE, NM 87102

CONTACT: KEN ROMIG | 505.764.9801

OTHER CONSULTANTS (FF&E)

LAB CASEWORK AND WORKSTATIONS CONSULT:

H2I GROUP
8676 CONCORD CENTER DR.
ENGLEWOOD, CO 80112

CONTACT: DUSTIN BAUER | 303.501.9824

FURNITURE CONSULT:

BECK TOTAL INTERIORS
9600 SAN MATEO BLVD. NE
ALBUQUERQUE, NM 87113

CONTACT: JAMIE FIELD | 505.459.5339

SIGNAGE CONCEPTS :

TAKEFORM
11601 MAPLE RIDGE RD.
MEDINA, NY 14103

CONTACT : JAMIE FULWELL | 800.528.1398

BIDDING DOCUMENTS

PLACEHOLDER FOR BOILERPLATE

DOCUMENT 00 31 32 GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 LOG OF BORINGS/CONTRACTOR RESPONSIBILITY

A. A copy of the locations and log of borings is bound herein. Subsurface soil data derived from test borings are given only for the convenience of the Contractor, and neither the Owner nor the Architect assumes responsibility for the accuracy of or for the Contractor's interpretation of the data. Contractor is responsible for any conclusions drawn from the boring data and is responsible for the work without extra compensation irrespective of whether or not the subsurface conditions encountered agree with the boring data.

1.2 REPORT

A. The full geotechnical report prepared by the Owner's independent geotechnical and testing laboratory is available in the Architect's office for inspection by the Contractor.

B. This geotechnical report is not a part of the Contract Documents.

END OF DOCUMENT

--- THIS PAGE INTENTIONALLY BLANK ---

Geotechnical Engineering Study

NMSU SENMC Vocational Trade Center
Carlsbad, Eddy County, New Mexico
LOI File No. J23-1-1144

Prepared for:
Nine Degrees Architecture & Design, Inc.
1817 Wyoming Ave., Ste. 2
El Paso, Texas 79903

Prepared by:
LOI ENGINEERS
2101 E. Missouri Avenue, Suite B
El Paso, Texas 79903

August 8, 2023

ENGINEERS

File No. J23-1-1144
August 8, 2023

Mr. Michael Bluth, Assoc. AIA
Nine Degrees Architecture & Design, Inc.
1817 Wyoming Ave., Ste. 2
El Paso, Texas 79903

Re: Geotechnical Engineering Report
NMSU SENMC Vocational Trade Center
Carlsbad, Eddy County, New Mexico

Dear Mr. Bluth:

We thank you for the opportunity to present the enclosed geotechnical engineering report for the above referenced project. This engineering report was prepared in accordance with the scope of services as presented in our proposal No. P23-1-01784, dated June 6, 2023, and authorized on June 6, 2022. The information we are presenting herein describes the procedures utilized for field and laboratory investigation, along with the results of our study.

It was a pleasure to work with you on this phase of your project, and we look forward to assist you further during the subsequent construction activities. If you have any questions regarding the information we present herein, please call us.

Respectfully submitted,
LOI ENGINEERS

BERNARDINO OLAGUE
NEW MEXICO
13301
PROFESSIONAL ENGINEER

Bernardino Olague, P.E., NMPE
Principal Engineer

8/8/23

Copies: Above (1) via E-mail
File (1)

Table of Contents

1.0 INTRODUCTION 1
2.0 PROJECT DESCRIPTION AND OBJECTIVE 1
3.0 FIELD AND LABORATORY INVESTIGATION 1
3.1 Field Exploration 1
3.2 Geotechnical Laboratory Testing 2
4.0 GENERAL SITE CONDITIONS 3
4.1 Site Geology 3
4.2 Site Topography and Site Conditions 3
4.3 Site Vegetation 3
4.4 Soil Stratigraphy 3
4.5 Groundwater 4
5.0 ENGINEERING EVALUATION 5
5.1 Structural Information 5
5.2 Vertical Movements 5
5.3 Site Preparation 5
5.4 Foundation Recommendations 5
5.5 Trench Guidelines 6
5.6 Floor Slabs 7
5.7 Site Drainage 7
5.8 Seismic Considerations 7
5.9 Flexible Pavement Recommendations 8
5.10 Rigid Pavement Recommendations 9
5.11 Select Fill 9
6.0 ADDITIONAL CONSIDERATIONS 10
6.1 Construction Monitoring 10
6.2 Limitations 12

APPENDIX A
General Location Map A-1.1
Boring Location Plan A-1.2
Boring Logs ..... A-2 – A-7
Summary of Results A-8

APPENDIX B
Soil Terminology B-1
Soil Symbols B-2

1.0 INTRODUCTION

We have completed the geotechnical engineering study for the proposed New Mexico State University (NMSU) SENMC Vocational Trade Center, which will be located at 150 E. University Drive, in Carlsbad, New Mexico. We were authorized to conduct this study by Michael Bluth, Assoc. AIA, representing Nine Degrees Architecture & Design, Inc. (Client) on July 6, 2023.

2.0 PROJECT DESCRIPTION AND OBJECTIVE

The project consists of the design and construction of a two-story 39,443-square foot building. The project will also include associated driveway and parking lots. The two-story building will be supported on shallow foundations. The project site is located at 150 E. University Drive, in Carlsbad, Eddy County, New Mexico. The site location is depicted on the General Location Map in Appendix A as Sheet A-1.1.

3.0 FIELD AND LABORATORY INVESTIGATION

3.1 Field Exploration

In our field exploration phase, we drilled and sampled four soil borings to a maximum depth of 16½ feet each, below ground surface, at representative locations within the proposed building footprint and two soil borings to a depth of 6½ feet each within the proposed pavement areas. We drilled and sampled the soil borings in general accordance with ASTM D-6151 and D-1586 procedures with a truck-mounted CME-75 drill rig. We located the borings in the field using property corners and street references included in the project plans provided by Client.

The soil boring locations are shown in the Boring Location Plan included in Appendix A of this report in Sheet A-1.2. We also prepared a log of each soil boring to delineate the soil strata studied at the site. The soil boring logs (B-1 through B-6) are included in Appendix

A of this report as Sheets A-2 through A-7. A key to the soil terminology used in the logs is included in Appendix B of this report as Sheets B-1 and B-2.

We conducted Standard Penetration Tests (SPT) at each representative soil strata in the soil borings to determine the relative density or consistency of the resident soils. The SPT is a widely recognized procedure that provides a numerical value of the soil strata being tested, indicating the number of blows that it takes for a standard 140-pound weight hammer with a standard 30-inch free fall drop to penetrate 12 inches into the soil. The SPT values for the soil strata in the soil borings are included in the soil boring logs.

As part of our field exploration, we collected representative soil samples from the soil borings at regular depth intervals using a standard 2-inch diameter split spoon sampler. We identified and labeled the samples according to boring number and depth, visually classified them according to ASTM D-2488, and placed them in moisture-proof containers for transportation to the laboratory for further evaluation and testing.

Unless we receive prompt notification from Client, we will store the samples collected from the field investigation in our laboratory for a period of 90 days from the date of this report, after which time we will discard the samples.

3.2 Geotechnical Laboratory Testing

In the laboratory, we determined the moisture content, particle size analysis, percent passing the No. 200 sieve, and Atterberg Limits of selected samples. We conducted these tests to determine the physical and engineering properties of representative soils at the site. These tests also allowed us to properly classify the resident soils in accordance with the Unified Soil Classification System (USCS). The results of our tests are included in the soil boring logs, adjacent to the depth at which the sample was recovered.

Table 1: Laboratory Testing Program

Type of Test	Number of Tests
Moisture Content (ASTM D-2216)	12
Percent Passing No. 200 Sieve (ASTM D-1140)	11

Grain Size Distribution Analysis (ASTM D-6913)	3
Atterberg Limits (ASTM D-4318)	6

4.0 GENERAL SITE CONDITIONS

4.1 Site Geology

According to the Natural Resources Conservation Services of the United States Department of Agriculture, the soils in this area correspond to the Upton Gravelly loam, which is described as steep soils composed of Residuum weathered from limestone.

4.2 Site Topography and Site Conditions

The project site slopes downward in easterly direction. The proposed site is currently vacant. At the time of our field subsurface exploration, the proposed site exhibited an undulating topography.

4.3 Site Vegetation

At the time of our field phase, the site exhibited dense native vegetation consisting of weeds, brittlebush, creosote bushes, shrubs, mesquite plants and trees, perennial grasses, and large rocks.

4.4 Soil Stratigraphy

The soils we encountered in the borings can be divided into three generalized soil strata as follows:

Stratum A, consisting of brown-multicolor medium to coarse gravel, intermixed with various amounts of sands and clays, was encountered from ground surface elevation, and extended to depths ranging from 2½ feet to 5 feet below ground surface (BGS) in borings B-1 through B-4. These soils were encountered at a very dense relative density, with SPT values of over 50 blows per foot of penetration. These soils were encountered at

a dry condition, with tested moisture content values ranging from 1 to 2 percent, and percent finer than the No. 200 sieve test results ranging from 21 to 27 percent. These soils exhibited tested liquid limit values ranging from 26 to 50 and yielded plasticity index values ranging from 7 to 24. Soils in this stratum can be classified as GC or GM-GC in accordance with the USCS.

Stratum B, consisting of brown fine grained clayey sands, occasionally intermixed with various amounts of gravel, was encountered from ground surface elevation and underlying the Stratum A and Stratum C soils in borings B-1 through B-6, and extended to depths ranging from 5 feet to 16½ feet BGS. These soils were encountered at loose to very dense relative density, with SPT values ranging from 7 to over 50 blows per foot of penetration. These soils were encountered at a dry to moist condition, with tested moisture content values ranging from 2 to 15 percent, and percent finer than the No. 200 sieve test results ranging from 16 to 34 percent. These soils exhibited tested liquid limit values ranging from 41 to 58 and yielded plasticity index values ranging from 22 to 23. Soils in this stratum can be classified as SC in accordance with the USCS.

Stratum C, consisting of brown lean and fat clays, occasionally intermixed with various amounts of sands and gravels, was encountered interbedding the Stratum B soils, and extended to depths ranging from 6½ feet to 15 feet BGS in the soil borings. These soils were encountered at a hard consistency, with SPT values ranging from 35 to over 50 blows per foot of penetration. These soils were encountered at a dry to moist condition, with tested moisture content values ranging from 6 to 11 percent, and percent finer than the No. 200 sieve test results ranging from 54 to 68 percent. These soils exhibited tested liquid limit values ranging from 31 to 54 and yielded plasticity index values ranging from 14 to 27. Soils in this stratum can be classified as CH or CL in accordance with the USCS.

4.5 Groundwater

Groundwater was not present in the borings drilled during the time of our field exploration. The groundwater table at the site is anticipated to be at depths well below the planned depth of the foundation system and related excavations at the site.

5.0 ENGINEERING EVALUATION

5.1 Structural Information

Based on our experience with similar projects, we have assumed wall and point loads on the order of 2,000 pounds per linear foot and 70 kips respectively, in our geotechnical engineering analysis. If the final loads differ significantly from the assumed values presented herein, LOI ENGINEERS should be notified immediately so that we may conduct further analysis to determine whether our recommendations need to be revised, as appropriate.

5.2 Vertical Movements

We calculated the Potential Vertical Rise (PVR) of the existing soil profile from our soil borings. The PVR value is 1¾ inches under dry moisture conditions for soils and conditions encountered in samples obtained from the soil borings.

Recommendations to reduce PVR values to less than 1-inch are presented below.

5.3 Site Preparation

Soils at their present condition may provide adequate support for foundations and/or slab-on-grade floors unless properly processed as indicated below.

We recommend that the upper 8 inches of soil within the proposed building footprint be processed as to achieve 95 percent and moisture-conditioned to within ±3 percent of the maximum dry density and optimum moisture content, respectively as determined by ASTM D-1557. This should be done prior to foundation and floor slab construction.

5.4 Foundation Recommendations

The proposed NMSU SENMC Vocational Trade Center may be supported on a shallow foundation system. This foundation system should be dimensioned using the parameters shown in the following table:

Table 2: Foundation Recommendations

Type of Foundation	Allowable Soil Bearing Capacity (lb./ft^2)	Minimum Footing Width (in.)	Minimum Footing Bearing Depth (in.)	Minimum Select Fill Below Bottom of Footing Elevation (in.)
Individual Spread	2,500	24	18	12
Continuous	2,350	12	18	12

The horizontal limits of over excavation shall extend 12 inches beyond the footing line.

Foundation systems designed and constructed based on the above data and parameters should experience total settlement of less than one inch. It is very important to provide adequate drainage to eliminate water accumulation or infiltration near the proposed building. Based on our settlement calculations using Schmertmann's method total settlements were estimated at 1-inch for a time equal to 1 year (T=1yr.).

Although differential settlement is typically estimated to be about one-half the total settlement (Ds=½-inch), differential movements across foundations may approach the total settlement if loose or soft soil deposits are left within the foundation footprints. The foundation system to be designed in accordance with the above criteria considers a safety factor of 3. Floor slabs should also be supported on select fill as recommended in Section 5.6 of this report.

5.5 Trench Guidelines

We recommend adequate protection on the faces of the excavations to prevent hazards from falling material. Adequate sloping on the faces of the excavations should also be implemented to avoid possible soil sloughing.

The Occupational Safety and Health Administration (OSHA) classifies soils for the purpose of defining stable slopes to be used in trenching applications.

The soils found during our field exploration, are considered Type C materials. For temporary slopes in soil trenching for this project, Type C soils can have a maximum slope of 1½:1 (H:V).

The contractor may be required to utilize shielded trench systems during the construction phase whenever excavations deeper than 5 feet are required taking into consideration site constraints such as vehicular traffic, existing underground lines (fuel, natural gas, telecommunication, and water), overhead lines, and existing structures.

We should note that the information included in this report is for design purposes only, and is not intended to provide a trench safety plan. The contractor should develop a trench safety plan in accordance with the requirements of OSHA and specifications in the project plans. If trench shields will be used, these should be selected appropriately to retain the lateral loads from the native coarse-grained soils.

5.6 Floor Slabs

Floor slabs for the proposed NMSU SENMC Vocational Trade Center should be built on a minimum of 8 inches of compacted select fill material or suitable subgrade soils. A modulus of subgrade reaction of 210 pounds per cubic inch may be used for backfill materials in the design of floor slabs.

5.7 Site Drainage

Positive surface drainage should be provided during and after construction by sloping the ground surface a minimum of two percent graded away from the structures for a minimum distance of 5 feet. Irrigated planters should not be allowed adjacent to the structures. Underground water and sewer lines should be properly installed underneath the structures to reduce the possibility of moisture infiltration in the event of plumbing leaks.

5.8 Seismic Considerations

The seismic site classification for the subject area was evaluated using the criteria given in the 2015 International Building Code (2015 IBC). Based on the project information and soil test borings, we recommend the parameters shown in Table 3 be used for design purposes.

Table 3: Seismic Design Parameters (2015 International Building Code)

Parameter	Value
Site Class	C
Site Location (latitude, longitude)	32.44299316, -104.26328082
S_{MS} – Spectral Response Acceleration for Short Periods	0.158g
S_{M1} – Spectral Response Acceleration for a 1-Second Period	0.077g
S_{DS} – Design Spectral Response Acceleration for Short Periods	0.105g
S_{D1} – Design Spectral Response Acceleration for a 1-Second Period	0.051g

5.9 Flexible Pavement Recommendations

Flexible pavements will be used in the construction of parking lots and driveways for the proposed NMSU SENMC Vocational Trade Center. Therefore, we used a traffic loading of 45,000 to 269,000 equivalent single-axle load (ESAL) applications for areas that will be subjected to light and heavy traffic loads, respectively. This parameter is estimated based on the parking characteristics and estimated heavy automobile traffic for a design period of 20 years. Additionally, based on our laboratory analysis we assigned a California Bearing Ratio (CBR) value of 20 for pavement design calculations.

We recommend that the flexible pavement consists of the following minimum thickness section for both light and heavy duty traffic conditions:

Table 4: Flexible Pavement Recommendations

Pavement Component	Light Duty Traffic Minimum Thickness (in.)	Heavy Duty Traffic Minimum Thickness (in.)
Hot-Mix Asphaltic Concrete	1½	2
Crushed Stone Base Course	5	7
Compacted Subgrade	8	10

As a minimum, the HMAC material should conform to Item 416, in accordance with the New Mexico Department of Transportation (NMDOT) Standard Specifications for Highway and Bridge Construction. The HMAC mix should have a minimum 1500 pounds of Marshall Stability when compacted at 75 blows in accordance with ASTM D-1559, and should have a flow between 8 and 16. The HMAC course should be placed at a target density of at least 98 percent.

The Crushed Stone Base Course (CSBC) should be Item 304.2.1:1, in accordance with the New Mexico Department of Transportation (NMDOT) Standard Specifications for Highway and Bridge Construction. CSBC materials should be placed in loose lifts not exceeding 6 inches in compacted thickness, and compacted to a minimum 100 percent of maximum dry density and moisture content within plus or minus 2 percent, in accordance with ASTM D-1557.

5.10 Rigid Pavement Recommendations

Rigid pavement sections may be required for frequent vehicle turning areas and other installations at the project site. Based on our rigid pavement design calculations and the traffic loading conditions described in Section 5.9, we recommend a jointed-reinforced concrete slab with a minimum thickness section forboth light and heavy duty traffic conditions:

Table 5: Rigid Pavement Recommendations

Traffic Conditions (ESAL's)	Jointly-Reinforced Slab Minimum Thickness (in.)	Select Fill Support (in.)
Light-Duty (45,000)	5	8
Heavy-Duty (269,000)	6	10

The above recommendations were generated considering concrete with a minimum 28-day compressive strength of 3,500 psi. Rigid pavement design should follow guidelines in accordance with ACI 330R-08.

5.11 Select Fill

Select fill material used for site grading should be granular, cohesionless, and free of deleterious material and particles over 4 inches in greatest dimension. Soils proposed for use as fill materials should be classified in accordance with ASTM D-2487. The following soils classified in accordance with the Unified Soil Classification System (USCS) can be considered satisfactory for use as select fill.

> GM, GC, GW-GM, GW-GC, GP, GP-GM and GP-GC, SM, SC, SW-SM, SW-SC, SP-SM, SW-SC and SC-SM.

The following USCS-classified soils are not considered satisfactory for use as select fill.

> CH, CL, MH, ML, OH, OL and PT, or soils that exceed a liquid limit of 40 and a plasticity index of 15.

The soils in our borings are suitable for use as select fill, provided they are properly processed to meet the above criteria for acceptable fill materials.

Select fill should be placed in uniform layers not exceeding 8 inches in compacted thickness, moisture-conditioned to add the amount of moisture required for optimum compaction and compacted to a minimum of 95 percent of maximum density in accordance with ASTM D-1557 (modified Proctor) procedures. The moisture content should be at plus or minus 3 percent of optimum moisture content in accordance with ASTM D-1557.

This compaction requirement also applies to the subgrade soils that will receive select fill. However, if the subgrade soils consist of cohesive soils such as CL or CH, or if the plasticity index exceeds 18, the subgrade soils should be compacted to a minimum of 90 percent of the above standard.

Compaction of the fill material and subgrade soils should be conducted with approved types of pneumatic, power or tamping equipment. Determination of density in the field should be conducted in accordance with ASTM D-2922 or D-1556.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Construction Monitoring

We recommend that Client retain LOI ENGINEERS during the construction phase of this project to verify the findings of our study, and to provide supplemental data to this study in the event that site conditions vary from those described in this report.

The geotechnical engineer should also conduct testing of fill materials used for earthwork operations at the following frequencies:

- At least one (1) moisture-density relationship (ASTM D-1557) and soil classification tests (ASTM D-6913 and ASTM D-4318) for each type of material encountered, or imported material to be used.
- Soil density (compaction) testing in accordance with ASTM D-6938 or D-1556 using the following testing frequencies:
    - Building pad area – A minimum of one (1) density test per lift (8-inch compacted) for every 1,000 square feet.
    - Pipe area – A minimum of one (1) density test per lift (8-inch compacted) for every 250 linear feet for pipe bedding and backfill operations, or at least three (3) tests per lift, whichever is greater.
    - Pavement area – A minimum of one (1) density test per lift (8-inch compacted) for every 1,000 square feet.

Sampling and testing for quality assurance of concrete materials should be performed at the following frequency:

- A minimum of one (1) set of four specimens should be collected for every 50 cubic yards of concrete placed, or fraction thereof. Concrete field testing shall include temperature, slump, and air content (if applicable).

Sampling and testing for quality assurance of asphaltic concrete materials should be performed at the following frequencies:

- A minimum of one (1) hot-mix asphaltic concrete (HMAC) analysis, to include Marshall test, Rice test, asphalt content and gradation, and Marshall flow and stability, for every 500 tons of HMAC material.
- A minimum of one (1) nuclear density test in accordance with ASTM D-2950 for every 1,000 square feet.

6.2 Limitations

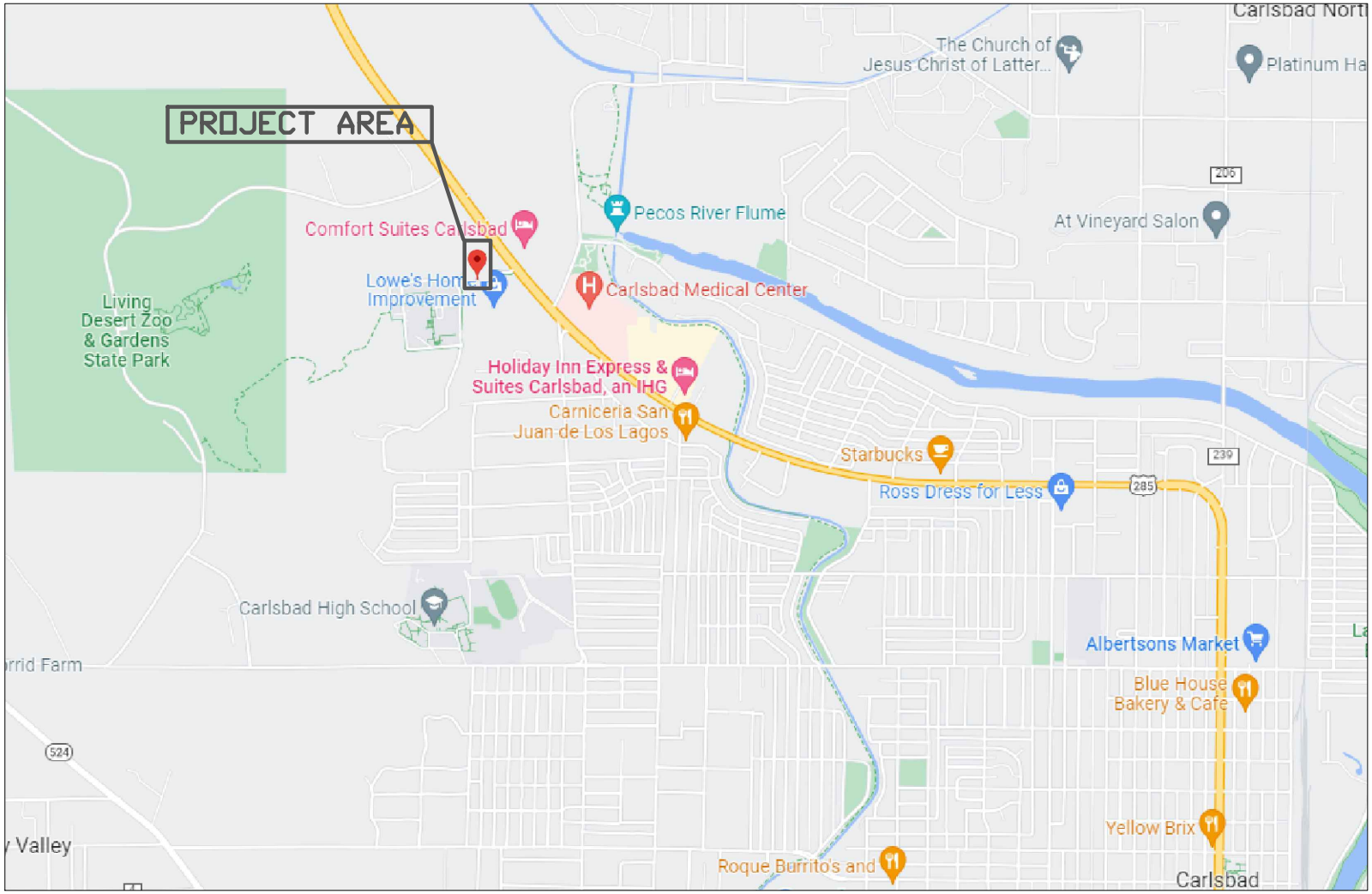
We have performed our professional services and have obtained the data presented in this report in accordance with generally accepted geotechnical engineering principles and practices. The information in this report is based on the data obtained from six (6) representative test borings and laboratory testing conducted on representative samples, and on our knowledge of the project conditions at the time of our subsurface soil study.

The data in this report reflects subsurface soil conditions only at the specific sampling location, time of sampling, and to the depths indicated in our report. This report is not intended to identify or address any potential environmental concerns associated with the project site.

We recommend that Client notify LOI ENGINEERS of any changes to the project conditions considered in this report, so that we may provide pertinent modifications to our recommendations if deemed necessary. Additionally, once construction commences, we should be notified of any unusual site conditions that appear to vary from those reported herein, so that we may conduct further investigations and prepare supplemental recommendations if deemed necessary.

We conducted this investigation for the purpose of defining the subsurface soil conditions for the NMSU SENMC Vocational Trade Center. Use of this information for projects other than the one described herein will not be adequate.

APPENDIX A



LEGEND	GEOTECHNICAL CONSULTANT	PROJECT CONSULTANT	DRAWING TITLE: GENERAL LOCATION MAP
APPROXIMATE PROJECT LOCATION	LOI ENGINEERS 915-781-1532 2101 E. MISSOURI AVE SUITE B EL PASO, TEXAS 79903	NINE DEGREES ARCHITECTURE & DESIGN, INC. 1817 WYOMING AVENUE, STE. 2 EL PASO, TEXAS 79903	PROJECT NAME: NMSU SENMC VOCATIONAL TRADE CENTER CARLSBAD, EDDY COUNTY, NEW MEXICO

DRAWN BY	REVIEWED BY	APPROVED BY	SCALE
S.V.	G.M.	B.O.	N.T.S.
PROJECT No.	**FILE NAME**	**DATE**	**SHEET No.**
J23-1-1144	SITE PLAN	07/7/2023	A-1.1

LEGEND	GEOTECHNICAL CONSULTANT	PROJECT CONSULTANT	DRAWING TITLE: BORING LOCATION PLAN
B-1 APPROXIMATE BORING LOCATION AND NUMBER	LOI ENGINEERS 915-781-1532 2101 E. MISSOURI AVE SUITE B EL PASO, TEXAS 79903	NINE DEGREES ARCHITECTURE & DESIGN, INC. 1817 WYOMING AVENUE, STE. 2 EL PASO, TEXAS 79903	PROJECT NAME: NMSU SENMC VOCATIONAL TRADE CENTER CARLSBAD, EDDY COUNTY, NEW MEXICO

DRAWN BY	REVIEWED BY	APPROVED BY	SCALE
S.V.	G.M.	B.O.	N.T.S.
PROJECT No.	**FILE NAME**	**DATE**	**SHEET No.**
J23-1-1144	SITE PLAN	07/7/2023	A-1.2

LOG OF TEST BORING No. B-1

Project name: NMSU SENMC Vocational Trade Center
File No.: J23-1-1144
Date Drilled: 7/20/23
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			GRAVEL, coarse grained, with sand and fat clay, brown-multi color, very dense, dry	GC	1	21	50	26	24	50	
			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC						50	
5										50	
			CLAY, lean, sandy, brown, hard, moist	CL	11	54				50	
10										50	
15			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC						50	
			Termination depth at 16.5 feet								
20											
25											
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JFL
Logger: LL
Sheet No.: **A-2**

LOG OF TEST BORING No. B-2

Project name: NMSU SENMC Vocational Trade Center
File No.: J23-1-1144
Date Drilled: 7/20/23
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			GRAVEL, coarse grained, with sand and clay, brown-multi color, very dense, dry	GC						50	
					1					50	
5			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC	2	25				50	
			CLAY, fat, sandy, brown, hard, dry to moist, with sand	CH	10	68	54	27	27	49	
10										50	
15			SAND, fine grained, clayey, brown, very dense, dry to moist, with gravel	SC						50	
			Termination depth at 16.5 feet								
20											
25											
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JFL
Logger: LL
Sheet No.: **A-3**

LOG OF TEST BORING No. B-3

Project name: NMSU SENMC Vocational Trade Center
File No.: J23-1-1144
Date Drilled: 7/20/23
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			GRAVEL, coarse grained, with sand and clay, brown-multi color, very dense, moist	GC						50	
			SAND, fine grained, clayey, brown, dense, moist, with gravel	SC	15	33	58	35	23	40	
5			-very dense at 5 feet	SC						50	
			CLAY, fat, brown, sandy, hard, dry to moist	CH						50	
10				CH	10	59				50	
15			SAND, fine grained, clayey, brown, very dense, dry to moist	SC						50	
			Termination depth at 16.5 feet								
20											
25											
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JFL
Logger: LL
Sheet No.: **A-4**

LOG OF TEST BORING No. B-4

Project name: NMSU SENMC Vocational Trade Center
File No.: J23-1-1144
Date Drilled: 7/20/23
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			GRAVEL, coarse grained, silty, clayey, brown-multi color, very dense, dry	GM-GC						50	
					2	27	26	19	7	50	
5			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC						50	
										50	
10			CLAY, fat, sandy, brown, hard, dry	CH						50	
15			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC	2	16				50	
			Termination depth at 16.5 feet								
20											
25											
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JFL
Logger: LL
Sheet No.: **A-5**

LOG OF TEST BORING No. B-5

Project name: NMSU SENMC Vocational Trade Center
File No.: J23-1-1144
Date Drilled: 7/20/23
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC	3	26				50	
										50	
5					5	34	41	19	22	46	
			Termination depth at 6.5 feet								
10											
15											
20											
25											
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JFL
Logger: LL
Sheet No.: **A-6**

LOG OF TEST BORING No. B-6

Project name: NMSU SENMC Vocational Trade Center
File No.: J23-1-1144
Date Drilled: 7/20/23
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			SAND, fine grained, clayey, brown, loose, dry to moist, with gravel							7	
			-medium dense at 2.5 feet	SC						13	
5			CLAY, lean, sandy, brown, hard, dry to moist	CL	6	67	31	17	14	35	
			Termination depth at 6.5 feet								
10											
15											
20											
25											
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JFL
Logger: LL
Sheet No.: **A-7**

SUMMARY OF RESULTS

Project: NMSU Vocational Trade Center

LOI Project No.: J23-1-1144

Date: 07/28/23

Boring No.	Depth (ft.)	% Moisture Content	% Material passing # 4	% Material passing # 40	% Material minus # 200	LL	PL	PI	Soil Classification
1	**0-1½**	**1**	58	32	**21**	50	26	24	Clayey gravel with sand (GC)
1	**7½-9**	**11**			**54**				Sandy fat clay (CH)
2	**2½-4**	**1**							
2	**5-6½**	**2**			**25**				Clayey sand with gravel (SC)
2	**7½-9**	**10**			**68**	54	27	27	Sandy fat clay with gravel (CH)
3	**2½-4**	**15**			**33**	58	35	23	Clayey gravel with sand (GC)
3	**10-11½**	**10**			**59**				Sandy fat clay (CH)
4	**2½-4**	**2**			**27**	26	19	7	Silty, clayey gravel with sand (GC-GM)
4	**15-16½**	**2**	60	29	**16**				Clayey sand with gravel (SC)
5	**0-1½**	**3**	58	32	**26**				Clayey sand with gravel (SC)
5	**5-6½**	**5**			**34**	41	19	22	Clayey sand with gravel (SC)
6	**5-6½**	**6**			**67**	31	17	14	Sandy lean clay (CL)

APPENDIX B

SOIL TERMINOLOGY

COARSE GRAINED SOILS: More than 50 percent retained on No. 200 sieve. Includes fine, medium, or coarse grained (depending on grain size) gravel and sand, and silty and/or clayey gravel and sand. Density is described according to relative density measured in the laboratory, or sampler resistance in the field as follows:

Penetration Resistance* (Blows per Foot)	Descriptive Term	Relative Density** (Percent)
0 – 4	Very Loose	0 - 15
5 - 9	Loose	15 – 35
10 - 29	Medium Dense	35 – 65
30 - 49	Dense	65 - 85
More than 50	Very Dense	85 - 100

* From Standard Penetration Test with 140-pound hammer, 30-inch drop.
** From relative density tests on undisturbed sand sample.

FINE GRAINED SOILS: More than 50 percent passing through the No. 200 sieve. Includes organic and inorganic silt and clay, gravelly and/or sandy silt and clay, silty clay, and clayey silt. Consistency is described according to shear strength, from unconfined compression tests in the laboratory, penetrometer tests in the field or laboratory, or sampler resistance in the field as follows:

Compressive Strength* (Tons per Square Foot)	Descriptive Term	Penetration Resistance** (Blows per Foot)
Less than 0.25	Very Soft	Less than 2
0.25 - 0.50	Soft	2 - 4
0.50 - 1.00	Firm	5 - 8
1.00 - 2.00	Stiff	9 - 15
2.00 - 4.00	Very Stiff	16 - 50
4.00 and higher	Hard	50 and higher

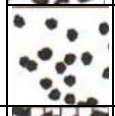
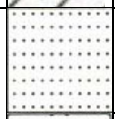
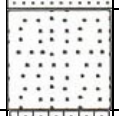
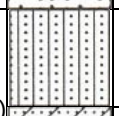
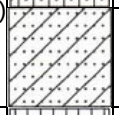
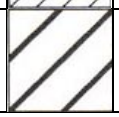
* From unconfined compression strength test.
** From Standard Penetration Test with 140-pound hammer, 30 inch drop.

Slicken sided: With inclined planes of weakness of slick and glassy appearance.
Fissured: With shrinkage cracks that are frequently filled with fine sand.
Laminated: With thin layers of varying colors and texture.
Interbedded: With alternate layers of different soil types.
Calcareous: With noticeable quantities of calcium carbonate.
Sensitive: Applies to cohesive soils that are subject to loss of strength when remolded.
Well graded: With wide range in grain sizes and good distribution of intermediate particle sizes.
Poorly graded: With one predominant grain size, or a poor distribution with intermediate sizes missing.

Sheet No. B-1

SOIL SYMBOLS

Identification of the major soil divisions used to distinguish the change of a different stratum. For their combinations and a more detailed description, see UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487-00)

MAJOR SOIL DIVISIONS			SOIL SYMBOL	USCS SYMBOL	TYPICAL NAME
Coarse-Grained Soils (< 50% pass No. 200 sieve)	GRAVELS (<50% pass No. 4 sieve)	Clean Gravels (< 5% pass No. 200 sieve)		**GW**	Well-Graded Gravels
				**GP**	Poorly-Graded Gravels
		Gravels with fines (> 12% pass No. 200 sieve)		**GM**	Silty Gravels
				GC	Clayey Gravels
	SANDS (> 50% pass No. 4 sieve)	Clean Sands (< 5% pass No. 200 sieve)		**SW**	Well-Graded Sands
				**SP**	Poorly-Graded Sands
		Sands with fines (> 12% pass No. 200 sieve)		**SM**	Silty Sands
				**SC**	Clayey Sands
Fine-Grained Soils (> 50% pass No. 200 sieve)	SILTS	Silts of Low Plasticity (*LL < 50)		**ML**	Inorganic Silts (slightly plastic)
		Silts of High Plasticity (*LL > 50)		**MH**	Inorganic Silts (elastic)
	CLAYS	Clays of Low Plasticity (*LL < 50)		**CL**	Inorganic Clays (lean clays)
		Clays of High Plasticity (*LL > 50)		**CH**	Inorganic Clays (Fat clays)

*Liquid Limit of the soil
NV: No value obtained; NP: Non-plastic

Sheet No. B-2

PROJECT MEMORANDUM

Date: February 7, 2025

To: Mr. Michael Bluth, Assoc. AIA
Nine Degrees Architecture & Design, Inc.
1817 Wyoming Avenue, Suite 2
El Paso, Texas 79903

Via: Bernardino Olague, P.E., PMP

From: Isaiah A. Montgomery

Subject: Southeast New Mexico College – Supplemental Recommendations
Carlsbad, Eddy County, New Mexico
File No. J24-1-1362

BERNARDINO OLAGUE
NEW MEXICO
13301
PROFESSIONAL ENGINEER
2/7/2025

This project memorandum provides supplemental recommendations to guide the design of a retaining wall structure for the subject project. The structural loads of the retaining wall are planned to be supported on shallow foundations. The project site is located along the eastern boundary of the Southeast New Mexico College property, in Carlsbad, Eddy County, New Mexico, as shown on the General Location Map in Appendix A as Sheet A-1.1.

Field Exploration

In our field exploration phase, we drilled and sampled three (3) soil borings to depths ranging from 20 feet to 25 feet, respectively, each below ground surface (BGS) at representative locations along the shoulder of the proposed retaining wall footprint. We drilled and sampled the soil borings in general accordance with ASTM D-6151 and D-1586 procedures with a truck-mounted CME-75 drill rig. We located the borings in the field using property corners and street references included in the project plans provided by Client. Soil boring B-1, which was originally planned to be at least 25 feet BGS along the proposed retaining wall footprint, was terminated at shallower a depth due to auger refusal.

The soil boring locations are shown in the Boring Location Plan included in Appendix A of this report in Sheet A-1.2. We also prepared a log of each soil boring to delineate the soil strata studied at the site. The soil boring logs (B-1 through B-3) are included in Appendix A of this report as Sheets A-2 through A-4. A key to the soil terminology used in the logs is included in Appendix B of this report as Sheets B-1 and B-2.

We conducted Standard Penetration Tests (SPT) at each representative soil strata in the soil borings to determine the relative density or consistency of the resident soils. The SPT is a widely recognized procedure that provides a numerical value of the soil strata being tested, indicating the number of blows that it takes for a standard 140-pound weight hammer with a standard 30-inch free fall drop to penetrate 12 inches into the soil. The SPT values for the soil strata in the soil borings are included in the soil boring logs.

As part of our field exploration, we collected representative soil samples from the soil borings at regular depth intervals using a standard 2-inch diameter split spoon sampler. We identified and labeled the samples according to boring number and depth, visually classified them according to ASTM D-2488, and placed them in moisture-proof containers for transportation to the laboratory for further evaluation and testing.

Unless we receive prompt notification from Client, we will store the samples collected from the field investigation in our laboratory for a period of 90 days from the date of this report, after which time we will discard the samples.

Geotechnical Laboratory Testing

In the laboratory, we determined the moisture content, particle size analysis, percent passing the No. 200 sieve, and Atterberg Limits of selected samples. We conducted these tests to determine the physical and engineering properties of representative soils at the site. These tests also allowed us to properly classify the resident soils in accordance with the Unified Soil Classification System (USCS). The results of our tests are

included in the soil boring logs, adjacent to the depth at which the sample was recovered.

Table 1: Laboratory Testing Program

Type of Test	Number of Tests
Moisture Content (ASTM D-2216)	12
Percent Passing No. 200 Sieve (ASTM D-1140)	3
Grain Size Distribution Analysis (ASTM D-6913)	9
Atterberg Limits (ASTM D-4318)	3

Soil Stratigraphy

The soils we encountered in the soil borings can be divided into three generalized soil strata as described in the following table:

Table 2: Subsurface Soil Stratigraphy

Soil Stratum	Stratum Encountered	Approximate Depth to Bottom of Stratum (ft.)	Soil Description
A	At Ground Surface: • B-1	10	Brown lean clays intermixed with various amounts of fine grained sand • USCS Classification – CL • Relative consistency – stiff to very stiff • SPT values – 11 to over 50 blows per foot • Moisture content – 5% to 6% • Material finer than #200 sieve – 58% to 69% • Liquid Limit (LL) – 34 • Plasticity index (PI) – 18
B	Underlying Stratum A soils: • B-1	5 to 26½	Brown-multicolor coarse grained poorly-graded gravel occasionally intermixed with various amounts of silt and sand • USCS Classification – GM, GP-GM, GP • Relative density – very dense • SPT values – over 50 blows per foot • Moisture content – 0% to 2% • Material finer than #200 sieve – 2% to 17%
	Interbedded in Stratum C soils: • B-2 and B-3		
	Underlying Stratum C soils: • B-3		
D	At Ground Surface • B-2 and B-3	10 to 26½	Brown fine grained clayey sands intermixed with various amounts of gravel • USCS Classification – SC • Relative density – very dense • SPT values – over 50 blows per foot • Moisture content – 2% to 5% • Material finer than #200 sieve – 15% to 43%
	Interbedded in Stratum B soils: • B-2 and B-3		
	Underlying Stratum B soils: • B-2		

Due to the relatively small diameter of the drilling and sampling tools utilized in our drilling program, we could not establish the maximum size of cobbles in the above strata. However, based on the degree of difficulty in our drilling program at the site, we anticipate that the size of cobbles will exceed 6 inches in diameter. During our drilling operations, auger refusal occurred at depths as shallow as 20 feet. Based on the natural stratigraphy in the vicinity of the project site, large boulders and rock formations may be encountered at depths of about 10 feet in certain locations. However, due to our drilling methodology and localized sampling, we could not verify the type, the presence or the extent of these possible formations.

Site Preparation

The surficial soil and vegetation in the site should be removed prior to fine grading operations. Based on the SPTs performed at the site, the majority of soils in the upper 10 feet below ground surface were encountered at a medium dense to very dense relative density. Soils at their present condition may provide adequate support for foundations and/or slab-on-grade floors, when properly processed, moisture-conditioned, and compacted as indicated in this report.

Foundation Recommendations

The structural loads of the proposed retaining wall may be supported on a shallow foundation system. This foundation system should be dimensioned using the parameters shown in the following table:

Table 3: Retaining Wall Foundation Recommendations

Proposed Wall Height (ft.)	Bearing Depth Below Existing Ground Surface Elevation (ft.)	Allowable Soil Bearing Capacity (psf)	Minimum Footing Width (in.)	Minimum Footing Depth (in.)	Structural Fill Below Bottom of Footing Elevation (in.)
14-19	5-12	2,500	30	12	12

The horizontal limits of over excavation shall extend 12 inches beyond the footing line.

Foundation systems designed and constructed based on the above data and parameters should experience total settlement of less than one inch. It is very important to provide adequate drainage to eliminate water accumulation or infiltration near the proposed retaining wall structure. Based on our settlement calculations using Schmertmann's method total settlements were estimated at 1-inch for a time equal to 1 year (T=1yr.).

Although differential settlement is typically estimated to be about one-half the total settlement (Ds=½-inch), differential movements across foundations may approach the total settlement if loose or soft soil deposits are left within the foundation footprints. The foundation system to be designed in accordance with the above criteria considers a safety factor of 3.

Retaining Walls Recommendations

We understand that the construction of a retaining wall structure will be required along the eastern boundary of the property line at the project site. Based on the plans provided and the site topography, the height of the proposed retaining wall may range from about 14 feet to a maximum of about 19 feet tall, and the foundation bearing depth below existing ground surface elevation may range between about 5 feet to 12 feet deep.

Therefore, we recommend the following parameters for the design of the retaining wall structure. These values may be used in earth pressure computations, considering the Rankine method for lateral earth pressure from existing backfill materials, coefficients of active and passive earth pressure are given below, along with the coefficient for the possible at-rest condition (K_a, K_p, K_o), as follows:

Table 4: Retaining Wall Recommendations

Existing Stratum	Φ (deg)	γ_w (lb/ft^3)	K_a	K_p	K_o
Clayey sand with gravel (SC)	31	120	0.31	3.25	0.47

The equivalent fluid density, considering the equivalent fluid method with the appropriate k value, may be computed as follows:

$$Gh = k*\gamma_w$$

G_h = fluid density

k = coefficient of earth pressure

γ_w = unit weight of soil

Additionally, the normal force between the soils and the wall per unit length of the wall, may be computed as follows:

$$P/b = 0.5*G_h*(\text{height of wall})^2$$

P = normal force

G_h = fluid density

For concrete or masonry walls, the wall-soil interface friction angle may be computed as follows:

$$\Phi_w = 0.67*\Phi$$

F = interface friction angle

The following soils classified in accordance with the Unified Soil Classification System (USCS) can be considered satisfactory for use as backfill material behind the retaining wall.

GM, GW-GM, GP, GP-GM and SM, SW-SM, and SP-SM.

Select Fill

Select fill material used for site grading should be granular, cohesionless, and free of deleterious material and particles over 4 inches in greatest dimension. Soils proposed for use as fill materials should be classified in accordance with ASTM D-2487. The following soils classified in accordance with the Unified Soil Classification System (USCS) can be considered satisfactory for use as select fill.

> GM, GC, GW-GM, GW-GC, GP, GP-GM and GP-GC, SM, SC, SW-SM, SW-SC, SP-SM, SW-SC and SC-SM.

The following USCS-classified soils are not considered satisfactory for use as select fill.

> CH, CL, MH, ML, OH, OL and PT, or soils that exceed a liquid limit of 40 and a plasticity index of 15.

<u>The soils in our borings are suitable for use as select fill, provided they meet the above criteria for acceptable fill materials. The Stratum A soils in our borings are **NOT** suitable for use as select fill.</u>

Select fill should be placed in uniform layers not exceeding 8 inches in compacted thickness, moisture-conditioned to add the amount of moisture required for optimum compaction and compacted to a minimum of 95 percent of maximum density in accordance with ASTM D-1557 (modified Proctor) procedures. The moisture content should be at plus or minus 3 percent of optimum moisture content in accordance with ASTM D-1557.

This compaction requirement also applies to the subgrade soils that will receive select fill. However, if the subgrade soils consist of cohesive soils such as CL or CH, or if the plasticity index exceeds 18, the subgrade soils should be compacted to a minimum of 90 percent of the above standard.

Compaction of the fill material and subgrade soils should be conducted with approved types of pneumatic, power or tamping equipment. Determination of density in the field should be conducted in accordance with ASTM D-2922 or D-1556.

Construction Monitoring

We recommend that Client retain LOI ENGINEERS during the construction phase of this project to verify the findings of our study, and to provide supplemental data to this study in the event that site conditions vary from those described in this report.

The geotechnical engineer should also conduct testing of fill materials used for earthwork operations at the following frequencies:

- At least one (1) moisture-density relationship (ASTM D-1557) and soil classification tests (ASTM D-6913 and ASTM D-4318) for each type of material encountered, or imported material to be used.
- Soil density (compaction) testing in accordance with ASTM D-6938 or D-1556 using the following testing frequencies:
    - Retaining Wall area – A minimum of one (1) density test per lift (8-inch compacted) for every 150 linear feet for pipe bedding and backfill operations, or at least three (3) tests per lift, whichever is greater.

Sampling and testing for quality assurance of concrete materials should be performed at the following frequency:

- A minimum of one (1) set of four specimens should be collected for every 50 cubic yards of concrete placed, or fraction thereof. Concrete field testing shall include temperature, slump, and air content (if applicable).

Limitations

We have performed our professional services and have obtained the data presented in this report in accordance with generally accepted geotechnical engineering principles and practices. The information in this report is based on the data obtained from three (3) representative test borings and laboratory testing conducted on representative samples, and on our knowledge of the project conditions at the time of our subsurface soil study.

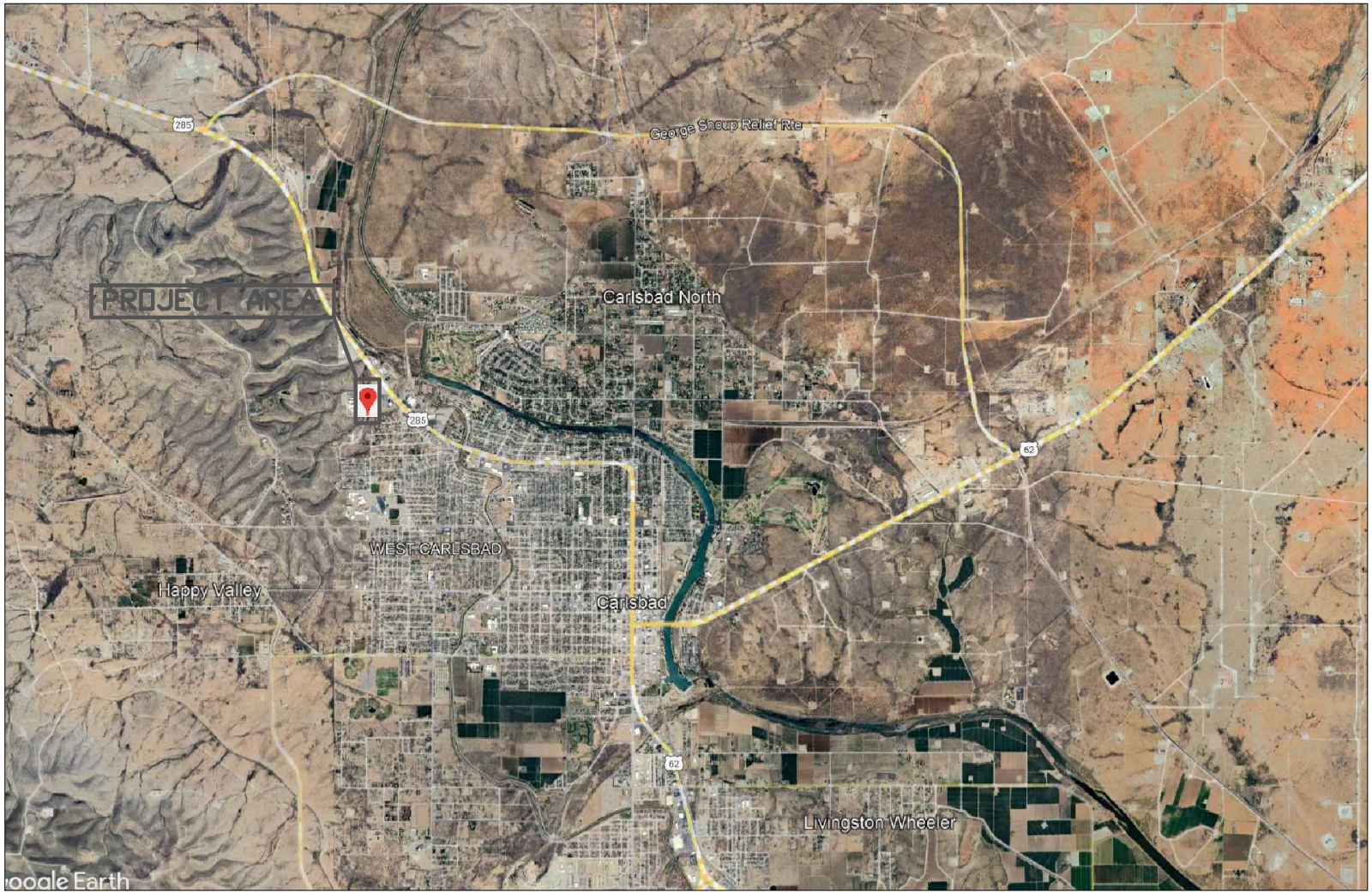
The data in this report reflects subsurface soil conditions only at the specific sampling location, time of sampling, and to the depths indicated in our report. This report is not intended to identify or address any potential environmental concerns associated with the project site.

We recommend that Client notify LOI ENGINEERS of any changes to the project conditions considered in this report, so that we may provide pertinent modifications to our recommendations if deemed necessary. Additionally, once construction commences, we should be notified of any unusual site conditions that appear to vary from those reported herein, so that we may conduct further investigations and prepare supplemental recommendations if deemed necessary.

We conducted this investigation for the purpose of defining the subsurface soil conditions for the proposed retaining wall structure that will be located along the eastern boundary of the Southeast New Mexico College property, in Carlsbad, Eddy County, New Mexico. Use of this information for projects other than the one described herein will not be adequate.

We appreciate the opportunity to work alongside you on this project. If you have questions regarding the information we present herein, please feel free to contact us.

APPENDIX A



LEGEND	GEOTECHNICAL CONSULTANT	PROJECT CONSULTANT	DRAWING TITLE: GENERAL LOCATION MAP
APPROXIMATE PROJECT LOCATION	LOI ENGINEERS 915-781-1532 2101 E. MISSOURI AVE SUITE B EL PASO, TEXAS 79903	NINE-DEGREES ARCHITECTURE & DESIGN, INC. 1817 WYOMING AVENUE, SUITE 2 EL PASO, TEXAS 79903	PROJECT NAME: SOUTHEAST NEW MEXICO COLLEGE – RETAINING WALL CARLSBAD, NEW MEXICO

DRAWN BY	REVIEWED BY	APPROVED BY	SCALE
I.M.	G.M.	B.O.	N.T.S.
PROJECT No.	**FILE NAME**	**DATE**	**SHEET No.**
J24-1-1362	SITE PLAN	02/07/2025	A-1.1

LEGEND	GEOTECHNICAL CONSULTANT	PROJECT CONSULTANT	DRAWING TITLE: BORING LOCATION PLAN
B-1 APPROXIMATE BORING LOCATION AND NUMBER	LOI ENGINEERS 915-781-1532 2101 E. MISSOURI AVE SUITE B EL PASO, TEXAS 79903	NINE-DEGREES ARCHITECTURE & DESIGN, INC. 1817 WYOMING AVENUE, SUITE 2 EL PASO, TEXAS 79903	PROJECT NAME: SOUTHEAST NEW MEXICO COLLEGE - RETAINING WALL CARLSBAD, NEW MEXICO

DRAWN BY	REVIEWED BY	APPROVED BY	SCALE
I.M.	G.M.	B.O.	N.T.S.
PROJECT No.	**FILE NAME**	**DATE**	**SHEET No.**
J24-1-1362	SITE PLAN	02/07/2025	A-1.2

LOG OF TEST BORING No. B-1

Project name: SENMC - Retaining Wall
File No.: J24-1-1362
Date Drilled: 01/30/25
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			CLAY, lean, sandy, brown, stiff, dry to moist	CL	5	58				11	
			- very stiff at 2.5 feet							16	
5					6	69	34	17	18	30	
			- hard at 7.5 feet							50+	50+
10			GRAVEL, poorly-graded, silty, brown-multicolor, very dense, dry, with sand	GP-GM	1	11				50+/9"	50+/9"
15										50+/4"	50+/4"
20			GRAVEL, poorly-graded, brown-multicolor, very dense, dry	GP	0	2				50+	50+
			Termination depth at 21 feet AUGER REFUSAL AT 21 FEET DUE TO LARE GRAVEL/ COBBLES								
25											
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JF
Logger: AT
Sheet No.: **A-2**

LOG OF TEST BORING No. B-2

Project name: SENMC - Retaining Wall
File No.: J24-1-1362
Date Drilled: 01/30/25
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC						50+/5"	50+/5"
					2	15				50+/1"	50+/1"
5										50+/5"	50+/5"
			GRAVEL, poorly-graded, silty, brown-multicolor, very dense, dry, with sand	GP-GM	1	12				50+	50+
10			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC						50+	50+
15										50+/2"	50+/2"
20			GRAVEL, coarse grained, silty, brown-multicolor, very dense, dry, with sand	GM	2	17				50+/2"	50+/2"
25			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC	4	35	27	14	13	50+	50+
			Termination depth at 26.5 feet								
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JF
Logger: AT
Sheet No.: **A-3**

LOG OF TEST BORING No. B-3

Project name: SENMC - Retaining Wall
File No.: J24-1-1362
Date Drilled: 01/30/25
Boring Location: See Sheet A-1.2
Elevation (ft): N/A North: N/A West: N/A

ENGINEERS

Elevation and Depth (ft.)	Samples	Soil symbols	Soil Description	USCS symbol	Moisture content,%	Minus #200 sieve, %	Liquid limit	Plastic limit	Plasticity index	Blows per foot (N)	SPT N-Value CURVE (10 30 50)
0			SAND, fine grained, clayey, brown, very dense, dry, with gravel	SC	3	18				50+/7"	50+/7"
					2	22				50+	50+
5			GRAVEL, poorly-graded, silty, brown-multicolor, very dense, dry, with sand	GP-GM						50+/9"	50+/9"
										50+	50+
10			SAND, fine grained, clayey, brown, very dense, dry to moist, with gravel	SC	5	43	42	24	19	50+	50+
15			GRAVEL, coarse grained, silty, brown-multicolor, very dense, dry, with sand	GM	1	13				50+	50+
20										50+	50+
25			GRAVEL, poorly-graded, silty, brown-multicolor, very dense, dry, with sand	GP-GM						50+	50+
			Termination depth at 26.5 feet								
30											

Groundwater Table Data

Depth	Date	Time
N/A	N/A	N/A

Sample Type
- Auger cutting
- 2" O.D. split spoon
- 3" O.D. split tube
- Thin-walled Shelby tube

Rig type: CME-75
Boring type: HSA
Drilled by: JF
Logger: AT
Sheet No.: **A-4**

SUMMARY OF RESULTS

Project: SENMC - Retaining Wall

LOI Project No.: J24-1-1362

Date: 2/7/2025

Boring No.	Depth (ft.)	% Moisture Content	% Material passing # 4	% Material passing # 40	% Material minus # 200	LL	PL	PI	Soil Classification
1	**0-1½**	**5**	94	84	**58**				Sandy lean clay (CL)
1	**5-6½**	**6**			**69**	34	17	18	Sandy lean clay (CL)
1	**10-11½**	**1**	46	17	**11**				Poorly-graded gravel with silt and sand (GP-GM)
1	**20-21½**	**0**	2	2	**2**				Poorly-graded gravel (GP)
2	**2½-4**	**2**	61	25	**15**				Clayey sand with gravel (SC)
2	**7½-9**	**1**	44	17	**12**				Poorly-graded gravel with silt and sand (GP-GM)
2	**20-21½**	**2**	40	27	**17**				Silty gravel with sand (GM)
2	**25-26½**	**4**			**35**	27	14	13	Clayey sand (SC)
3	**0-1½**	**3**	55	28	**18**				Clayey sand with gravel (SC)
3	**2½-4**	**2**	66	32	**22**				Clayey sand with gravel (SC)
3	**10-11½**	**5**			**43**	42	24	19	Clayey sand (SC)
3	**15-16½**	**1**	35	18	**13**				Silty gravel with sand (GM)

APPENDIX B

SOIL TERMINOLOGY

COARSE GRAINED SOILS: More than 50 percent retained on No. 200 sieve. Includes fine, medium, or coarse grained (depending on grain size) gravel and sand, and silty and/or clayey gravel and sand. Density is described according to relative density measured in the laboratory, or sampler resistance in the field as follows:

Penetration Resistance* (Blows per Foot)	Descriptive Term	Relative Density** (Percent)
0 – 4	Very Loose	0 - 15
5 - 9	Loose	15 – 35
10 - 29	Medium Dense	35 – 65
30 - 49	Dense	65 - 85
More than 50	Very Dense	85 - 100

* From Standard Penetration Test with 140-pound hammer, 30-inch drop.
** From relative density tests on undisturbed sand sample.

FINE GRAINED SOILS: More than 50 percent passing through the No. 200 sieve. Includes organic and inorganic silt and clay, gravelly and/or sandy silt and clay, silty clay, and clayey silt. Consistency is described according to shear strength, from unconfined compression tests in the laboratory, penetrometer tests in the field or laboratory, or sampler resistance in the field as follows:

Compressive Strength* (Tons per Square Foot)	Descriptive Term	Penetration Resistance** (Blows per Foot)
Less than 0.25	Very Soft	Less than 2
0.25 - 0.50	Soft	2 - 4
0.50 - 1.00	Firm	5 - 8
1.00 - 2.00	Stiff	9 - 15
2.00 - 4.00	Very Stiff	16 - 50
4.00 and higher	Hard	50 and higher

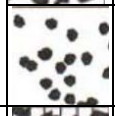
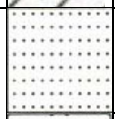
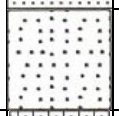
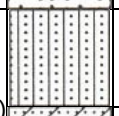
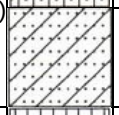
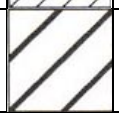
* From unconfined compression strength test.
** From Standard Penetration Test with 140-pound hammer, 30 inch drop.

Slicken sided: With inclined planes of weakness of slick and glassy appearance.
Fissured: With shrinkage cracks that are frequently filled with fine sand.
Laminated: With thin layers of varying colors and texture.
Interbedded: With alternate layers of different soil types.
Calcareous: With noticeable quantities of calcium carbonate.
Sensitive: Applies to cohesive soils that are subject to loss of strength when remolded.
Well graded: With wide range in grain sizes and good distribution of intermediate particle sizes.
Poorly graded: With one predominant grain size, or a poor distribution with intermediate sizes missing.

Sheet No. B-1

SOIL SYMBOLS

Identification of the major soil divisions used to distinguish the change of a different stratum. For their combinations and a more detailed description, see UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487-00)

MAJOR SOIL DIVISIONS			SOIL SYMBOL	USCS SYMBOL	TYPICAL NAME
Coarse-Grained Soils (< 50% pass No. 200 sieve)	GRAVELS (<50% pass No. 4 sieve)	Clean Gravels (< 5% pass No. 200 sieve)		**GW**	Well-Graded Gravels
				**GP**	Poorly-Graded Gravels
		Gravels with fines (> 12% pass No. 200 sieve)		**GM**	Silty Gravels
				GC	Clayey Gravels
	SANDS (> 50% pass No. 4 sieve)	Clean Sands (< 5% pass No. 200 sieve)		**SW**	Well-Graded Sands
				**SP**	Poorly-Graded Sands
		Sands with fines (> 12% pass No. 200 sieve)		**SM**	Silty Sands
				**SC**	Clayey Sands
Fine-Grained Soils (> 50% pass No. 200 sieve)	SILTS	Silts of Low Plasticity (*LL < 50)		**ML**	Inorganic Silts (slightly plastic)
		Silts of High Plasticity (*LL > 50)		**MH**	Inorganic Silts (elastic)
	CLAYS	Clays of Low Plasticity (*LL < 50)		**CL**	Inorganic Clays (lean clays)
		Clays of High Plasticity (*LL > 50)		**CH**	Inorganic Clays (Fat clays)

*Liquid Limit of the soil
NV: No value obtained; NP: Non-plastic

Sheet No. B-2

TECHNICAL SPECIFICATIONS

SECTION 01 11 00

SUMMARY OF WORK

GENERAL

1.1 SUMMARY

A. Related Requirements:
   1. Document 00 70 00 - General Conditions of the Contract for Construction: Provisions for use of site; Owner occupancy; Relations of Contractor - subcontractors.
   2. Section 01 32 16 - Construction Progress Schedules: Format of work schedule.
   3. Section 01 45 23 - Testing and Inspection Services.
   4. Section 01 50 00 - Temporary Facilities and Controls.

1.2 DESCRIPTION

A. The work comprises the construction of a New 42,000 sf two story Trades and Technologies Vocational Building in Carlsbad, NM, as shown on the drawings and described in the specifications. The work will be done under one lump sum contract, with separate pricing for FF&E. **The project is seeking LEED Silver Certification. Contractor shall coordinate as needed with a LEED Consultant to obtain all Contractor and Field Credits.**

*THIS LIST IS NOT ALL INCLUSIVE - REFER TO THE DRAWINGS FOR FULL DETAILS OF WORK
CONSTRUCTION AND SITE WORK FOR (1) ONE NEW ENERGY TRADES BUILDING FOR SOUTHEAST NEW MEXICO COLLEGE

- NEW APPROX. 42,392 SF BUILDING
- SITE WORK INCLUDING LIGHTING, PARKING (ADA INCLUDED), DRIVE AISLE AND ACCESS, CONCRETE FLAT WORK TO PROVIDE ACCESSIBLE ACCESS TO THE BUILDING,
- PONDING, LANDSCAPE AND IRRIGATION SCOPE NEEDS TO BE INCLUDED
- SITE WORK TO INCLUDE PAD PREP AND PERMANENT FIRE DEPARTMENT ACCESS ROAD (PAVED) AT SITE PERIMETER.
- ALL ASSOCIATED PLUMBING, MECHANICAL, ELECTRICAL, AND SPECIAL SYSTEMS FOR A FULLY FUNCTIONING (TURN-KEY) ENERGY TRADES BUIDLING (42,392 SF)
- EXTERIOR ENVELOPE AS INDICATED ON DRAWINGS, TO INCLUDE METAL PANELS, EIFS SYSTEMS, ADHERED STONE, AND CURTAIN WALLS.
- PROJECT GOAL IS TO ATTAIN LEED SILVER CERTIFICATION.

B. Indication on the drawings or mention in the specifications of articles, materials, operations or methods requires that the Contractor provide each item indicated or mentioned of the quality or subject to the qualifications noted, and perform according to the conditions stated each operation described and provide therefor all necessary labor, equipment, services and incidentals.
   1. Subcontractors are responsible for examining the architectural drawings for structural, mechanical, electrical, and plumbing items. Items shown on these drawings shall be furnished by the appropriate subcontractor.

1.3 CONDITIONS OF THE CONTRACT

A. The General Conditions (Modified), bound herewith as preceding portions of these specifications, form a part thereof and shall govern the work under each section.
B. The General Contractor shall extend a Good Faith Effort with proof submitted to hire local labor on the project to an extent of not less than 30% of the total labor of the project.

1.4 EXISTING SITE CONDITIONS

A. Visit and examine the site. Upon award of the Contract, the Contractor shall accept the condition of the site before beginning the work required.

1.5 SPECIAL REQUIREMENTS

A. Assume responsibility for the protection of areas of work and provide and maintain protections required.

B. Execute Certificate of Substantial Completion for each designated portion of work prior to Owner occupancy. Following execution of a Substantial Completion Certificate for a designated portion of the work, the Contractor shall permit:
   1. Access for Owner personnel.
   2. Use of parking facilities for the benefit of the Owner.
   3. Operation of HVAC and electrical systems for the benefit of the Owner.

   Despite partial Owner occupancy, the Contractor shall remain responsible for portions of the work which have not attained Substantial Completion and for which a Substantial Completion Certificate, which shall designate the date on which the Owner shall become responsible for utilities, maintenance, security, damage to the work and insurance, has not been executed.

C. The loop fire lane and fire hydrants are required by the City and State Fire Marshal to be in place prior to steel erection.

1.6 CONTRACTOR USE OF PREMISES

A. Assume full responsibility for protection and safekeeping of products under this contract.

B. Obtain and pay for use of additional storage or work areas needed when required for operations under this Contract.

C. There shall be no fires on the site or in the building. There shall be no dumping on Owner's property.

D. Worker Identity Badging Requirements: Provide construction personnel (including subcontractors and suppliers regularly visiting the project site) with identification badges, with photograph. Identification badges shall be worn visibly by construction personnel on the construction site or on Owner’s property. NO EMPLOYEE WILL BE PERMITTED ON SITE WITHOUT THIS BADGE DISPLAYED ON THE EMPLOYEE.
   Contractor must assure that the Crisis Management contact information is provided on the reverse side of each worker’s badge. Temporary or visitor badges will be provided for persons who are identified as having an infrequent or temporary legitimate business need for access to the site.

1.7 OWNER-FURNISHED PRODUCTS

A. Contractor Responsibilities
   1. Protect products from damage.
   2. Repair or replace items damaged by Contractor.
   3. Make all necessary electrical and plumbing service connections to Owner supplied Equipment.

B. Schedule of Owner-furnished and Contractor-installed items
   1. Toilet Accessories as indicated.
   2. Refer to Drawings.

1.8 COORDINATION

A. Drawing details and other sections of these specifications covering work connected with or relating to that specified under a specific heading shall be examined for conditions which may affect that part of the work. Failure to do so will not relieve those furnishing materials and/or labor under a

specification heading from supplying materials or performing work reasonably necessary to properly coordinate their work with that of other trades.

1.9 LAYING OUT WORK, MEASUREMENTS

A. Employ a competent engineer or surveyor to establish and maintain lines and levels. Establish and maintain at least two elevation bench marks remote from each other and located outside the building area. Set alignment and location stakes.

B. Verify measurements at the building. No extra compensation will be allowed for differences between actual dimensions and dimensions indicated on the drawings. Figured dimensions and measurements taken at the site shall take precedence over scaled dimensions.

1.10 DISCREPANCIES

A. In case of discrepancies within the drawings, within the specifications, or between the drawings and specifications, the better quality and greater quantity, in the opinion of the Architect, shall be furnished and installed.

1.11 PIPING

A. Should active piping or conduit be encountered below grade within the building structure and be found at variance with the known conditions indicated by the drawings and specifications, said piping and/or conduit shall be relocated as required by the Architect, and the contract sum shall be fairly adjusted on the basis of the cost of labor and materials. The Contractor shall provide temporary support of active piping and conduit encountered in the excavations until permanently supported or removed. The Contractor shall cut off and cap or plug abandoned lines at least 3 ft. outside the building lines. Conform to the applicable requirements of the locality or governing agency.

1.12 PROTECTION

A. General: Limit use of the premises to construction activities in areas indicated.
   1. Confine operations to areas within Contract limits indicated.
   2. Keep driveways and entrances serving the premises clear of debris. Do not use these areas for parking or storage of materials without prior approval. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
   3. Do not dispose of organic and hazardous material on site, either by burial or by burning. Disposable material and trash must be removed properly.

B. Assume responsibility for the premises and provide and maintain protections required by the governing laws, regulations and ordinances. The Contractor shall be responsible for loss or damage caused by him or his workmen to the property of the Owner or to the work or materials installed, and shall make good loss, damage or injury without cost to the Owner.

C. The protection of adjacent property shall include but will not necessarily be limited to the erection and maintenance of shoring, underpinning and fences as necessary to protect and support existing work to be left in place.

D. Finished floors shall be protected against damage by workmen and equipment during the work. Where materials are carried into the building, the building floors shall be covered to protect the work against dirt or grit being ground in.

E. Trees and shrubs on the site which do not have to be removed for the new work shall be protected against damage. No Contractor shall remove or trim trees and shrubs in the area without the express approval of the Architect.

F. Send proper notices, make necessary arrangements and perform other services required for the care, protection and maintenance of Public Utilities, including fire plugs and wires and other items of this character on and around the building site.

G. Maintain accessible building exits required by the AHJ during construction. Protection of these exits shall include dust-proof enclosures, illumination and exit lighting required.

1.13 RECORD DRAWINGS

A. Maintain a complete clean set of drawings and Project Manual in the project field office for the sole purpose of recording "installed" conditions. Installed conditions shall include addendum items, change orders, or other items which come up during the construction phase which deviate from the Construction Documents. Changes made in these drawings and Project manual in connection with the final construction and installation shall be neatly made in red ink. Upon completion of the project, the marked set of drawings and Project Manual shall be delivered to the Architect for subsequent transmittal to the Owner. These drawings shall be maintained to reflect the current conditions of the work and changes shall be reviewed on a monthly basis with the Architect’s representative. The Contractor's updating of the "installed" condition drawings and Project Manual shall be a prerequisite to the monthly review of the Contractor's payment request by the Architect's representative.

1.14 INSTRUCTIONS CONCERNING ASBESTOS

A. In the event the Contractor encounters on the site material reasonably believed to be asbestos which has not been rendered harmless, the Contractor shall immediately stop work in the area affected and report the condition to the Owner in writing. If, in fact the material is asbestos and has not been rendered harmless, the work in the affected area shall not thereafter be resumed until the asbestos has been removed or rendered harmless by the Owner. The work in the affected area shall be resumed in the absence of asbestos, or when it has been rendered harmless, by written agreement of the Owner and Contractor.

B. The Contractor will not be required to perform without consent work relating to asbestos.

PRODUCTS

Not used

PART 2 - EXECUTION

Not used

END OF SECTION

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements governing allowances.
   1. Certain materials and equipment are specified in the contract documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by change order.

B. Related Requirements:
   1. General Conditions of the Contract for Construction.
   2. Section 01 22 00 - Unit Prices; procedures for using unit prices.
   3. Section 01 32 16 - Construction Progress Schedules: Product delivery and installation dates.
   4. Individual Specifications Sections Listed Under Schedule of Allowances: Specification of products and installation under allowances.

1.2 COSTS INCLUDED IN ALLOWANCES

A. Cost of product to Contractor or subcontractor, less applicable trade discounts.

B. Delivery to site.

C. Applicable taxes.

1.3 CONTRACTOR COSTS INCLUDED IN CONTRACT SUM

A. Products handling at site, including unloading, uncrating and storage.

B. Protection of products from elements and from damage.

C. Labor for installation and finishing.

D. Other expenses required to complete installation.

E. Contractor overhead and profit.

1.4 ADJUSTMENT OF COSTS

A. Should the net cost be more or less than the specified amount of the allowance, the contract sum will be adjusted accordingly by change order.

B. Submit any claims for anticipated additional costs at the site, or other expenses caused by the selection under the allowance, prior to execution of the work.

C. Submit documentation for actual additional costs at the site, or other expenses caused by the selection under the allowance, prior to execution of the work.

D. Failure to submit claims within the designated time will constitute a waiver of claims for additional costs.

1.5 ARCHITECT RESPONSIBILITIES

A. Consult with Contractor in consideration of products, suppliers and installers.

B. Select products, obtain Owner's written decision, and transmit full information to Contractor as follows
   1. Manufacturer, product, model or catalog number, accessories, attachments and finishes.
   2. Supplier and installer as applicable.
   3. Cost to Contractor, delivered to site (and installed, if so specified).

1.6 CONTRACTOR RESPONSIBILITIES

A. At the earliest practical date after award of the contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the work.

B. Assist Architect in determining suppliers; and installers; obtain proposals when requested.

C. Make recommendations for Architect consideration.

D. Promptly notify Architect of any reasonable objections against supplier or installer.

E. On notification of selection execute purchase agreement with designated supplier and installer.

F. Arrange for and process shop drawings, product data and samples.

G. Arrange for delivery. Promptly inspect products upon delivery for completeness, damage and defects. Submit claims for transportation damage.

H. Install, adjust and finish products.

I. Provide warranties for products and installation.

1.7 CORRELATION WITH CONTRACTOR SUBMITTALS

A. Schedule shop drawings, product data, samples and delivery dates, in progress schedule for products selected under allowances.

PART 2 - PRODUCTS – Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate allowance work with related work to ensure proper integration and interface.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. #1 Allowance: Include the sum of a total of $2,000,000.00 (Two Million Dollars), unused returnable to the Owner, as a project contingency to be used at the discretion of the owner for unforeseen conditions and/or owner's requested additions.

1. This allowance includes material cost, receiving, handling, and installation and Contractor overhead and profit (IF APPLICABLE).

END OF SECTION

SECTION 012305
BID LOTS

PART 1 - GENERAL

RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Bid Lots.

1.3 DEFINITIONS

A. Bid Lots: Bid Lots are individual Bid Packages and shall be priced separately. Bid Lots may or may not be accepted by the Owner and awarded to the successful Bidder.

1. Bid Lots described in this Section are part of the Work only if enumerated in the Agreement.
2. The costs for each Bid Lot is the net Bid amount to complete the work indicated in the Bid Lot, into the Work. The total Contract Sum will be the total amount of Base Bid and Bid Lots accepted, combined.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of each accepted Bid Lot.

1. Include as part of each Bid Lot, work required to modify work included in other accepted Bid Lots to accommodate and integrate work in the Bid Lot, and include the costs of miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not specifically indicated as part of Bid Lot.

B. Execute all accepted Bid Lot work under the same conditions as other accepted work of the Contract.

C. Immediately after award of the Contract, advise all necessary personnel and suppliers of Bid Lot work that has been accepted or rejected by Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF BID LOTS

*THIS LIST IS NOT ALL INCLUSIVE - REFER TO THE DRAWINGS FOR FULL DETAILS OF WORK

BASE BID – ALL BUILDING, SITE, AND SYSTEMS CONSTRUCTION FOR A FULLY FUNCTIONING TRADES AND TECHNOLOGIES BUIILDING

- Provide all costs to include labor and materials for the construction of a new trades and technologies building, including structural, architectural, mechanical, electrical, and plumbing systems; interior and exterior finishes, site and landscape and complete build-out of first-floor labs & classrooms for Oil & Gas Technologies, Industrial Maintenance, Electrical Trades, and Environmental Technology. Complete build-out for second floor classrooms, labs, computer testing labs, and office spaces as shown in the contract drawings.

BID LOT #1 – NEW SEWER CONNECTION FROM MAIN HIGHWAY INTO CAMPUS

- Provide all scope for sawcutting existing street, trenching, and installation of new Sewer Piping, Manholes, and all other items identified in the separate Civil Utilities package supplied by the Project Civil Engineer (High Mesa).

- This work will be required to be completed as part of the project scope, as this provides the Sewer Point of Connection to the new Building.

BID LOT #2 – FURNITURE, FIXTURES, & EQUIPMENT (FF&E)

- Provide all costs to furnish, deliver, and install all furniture as outlined in specification sections 120000 FURNITURE, and Sheets A655 and A656 in the Contract Drawings.
- Provide all costs to furnish, deliver, and install all Metal Laboratory Casework, Laboratory Service Carriers, and Fume Hoods as outlined in sections 123510 LABORATORY SERVICE CARRIERS, & 123553 METAL LABORATORY CASEWORK AND FUME HOODS and Sheets A655 and A656 in the Contract Drawings.
- Provide all costs to furnish, deliver, and install all Marker Boards and Tack boards, Interior and Exterior Waste and Recycle Receptacles as outlined in specification sections 101116 MARKERBOARDS & TACKBOARDS, 102801 WASTE AND RECYCLE RECEPTACLES, and Sheets A655 and A656 in the Contract Drawings.

END OF SECTION 01 2305

SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

   1. Substitution Request Form: Use [**CSI Form 13.1A**].
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size,

durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research reports evidencing compliance with building code in effect for Project, from [**ICC-ES**].
i. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within [**seven**] days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within [**15**] days of receipt of request, or [**seven**] days of receipt of additional information or documentation, whichever is later.

   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than [**15**] days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Substitution request is fully documented and properly submitted.
   c. Requested substitution will not adversely affect Contractor's construction schedule.
   d. Requested substitution has received necessary approvals of authorities having jurisdiction.
   e. Requested substitution is compatible with other portions of the Work.
   f. Requested substitution has been coordinated with other portions of the Work.
   g. Requested substitution provides specified warranty.
   h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

END OF SECTION 012500

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Applications and Certificates for Payment.
   2. Change Order Procedures.
   3. Schedule of Values: Submit to the Architect the Schedule of Values allocated to various portions of the work within five days after "Notice-to-Proceed". Upon request of Architect, support values with data which will substantiate their correctness.

B. Related Requirements:
   1. Conditions of the Contract for Construction.
   2. Section 01 32 16 - Construction Progress Schedules.
   3. Section 01 77 00 - Closeout Procedures.
   4. Section 01 78 39 - Project Record Documents.

1.2 APPLICATIONS AND CERTIFICATES FOR PAYMENT

A. Progress payments shall be made as the work proceeds at intervals stated in the Contract.

B. Work covered by progress payments shall, at the time of payment, become the property of the Owner.

C. Form of Application and Certificate for Payment shall be notarized AIA Document G702 - Application and Certification for Payment, supported by AIA document G703 - Continuation Sheet, submitted in quintuplicate.

D. Conditions governing regular schedule for applications, payment and retainage are as stated in the Contract.

E. With each Application for Payment, Contractor shall certify that such Application for Payment represents a just estimate of cost reimbursable to Contractor under terms of Contract.

1.3 CONSTRUCTION CHANGE ORDER PROCEDURES

A. Contractor to submit to Architect within five days of execution of Owner/Contractor Agreement name of individual authorized to accept changes on behalf of Contractor, and to be responsible for informing others in Contractor's employ of changes in the work.

B. Change Order forms will be furnished and issued by Architect.

C. Contractor Documentation of Changes:
   1. Maintain detailed records of work done on an accounting basis acceptable to Architect and Owner. Provide full information required for evaluation of proposed changes.
   2. Document each quotation for a change in cost or time with sufficient data to allow evaluation of quotation.
   3. On request, provide additional data to support computations:
      a. Quantities of products, labor and equipment.
      b. Insurance and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   4. Support each request for additional costs, and for work proposed on a time and material

basis, with description of products, equipment, cost of labor and subcontracts, completely documented.
5. Computation for changes in work will be computed in one of the manners described in the Conditions of the Contract.

D. Initiation of Changes:
1. Architect may submit Proposal Request which includes detailed description of change with supplementary or revised drawings and specifications.
2. Contractor may initiate a proposed change by submittal of a request to Architect describing proposed change with statement of reason for change, and proposed effect on Contract Sum and Contract Time with full documentation and a statement of the effect on work of separate contractors. Document any requested substitutions in accordance with SECTION 01 62 00 - PRODUCT OPTIONS. Submission of such requests and receipt of same by Architect does not mean acceptance, or approval of proposed change.

E. Authorization:
1. The Owner may request, through the Architect, a Construction Change Directive, in writing, instructing Contractor to proceed with changes of all or in part of work, for subsequent inclusion in a Change Order that is pending. Directive will propose basis for necessary adjustments, if any, to Contract Sum or Time.
2. Changes that affect Contract Sum and/or Contract Time will require a Change Order signed by the Owner and the Architect. Contractor's signature indicates agreement. Other orders, written or oral, by the Owner through the Architect or by the Architect shall be treated as a Change Order only if Contractor gives Owner proper written notice as described in Conditions of Contract.
3. Promptly execute the change in work only upon receipt of approved Change Order or Owner's written Construction Change Directive.

F. Execution:
1. Architect will issue Change Orders for signatures of parties as provided in Conditions of Contract.
2. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust Contract Sum as shown on Change Order.
3. Promptly revise Progress Schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by Change, and resubmit Schedule.
4. Promptly enter Changes in Project Record Documents.

1.4 SCHEDULE OF VALUES FORM AND CONTENT

A. Type schedule on 8-1/2" x 11" white paper; Contractor's standard forms and automated printout will be considered for approval by Architect upon Contractor's request. Identify schedule with:
1. Title of project and location.
2. Architect and Architect's project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Follow the table of contents of this project manual as the format for listing component items.
1. Identify each line item with the number and title of the respective major section of the specifications.

C. For each major line item list sub-values of major products or operations under the item.

D. For the various portions of the work:
1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
2. For items on which progress payments will be requested for stored materials, break down the value into:

a. Cost of the materials, delivered and unloaded, with taxes paid.
b. Total installed value.

E. The sum of values listed in the schedule shall equal the total contract sum.

F. Indicate separate value associated with materials and labor.

G. Re-submittal: After review by Architect, revise and resubmit schedule as necessary.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Coordination of work of the contract.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Sequence of construction and Owner occupancy.
2. Section 01 31 19 - Project Meetings.
3. Section 01 62 00 - Product Options.
4. Section 01 73 29 - Cutting and Patching.
5. Section 01 77 00 - Closeout Procedures: Closeout submittals.

1.2 DESCRIPTION

A. Coordinate scheduling, submittals and work of the various sections of specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

B. Coordinate sequence of work to accommodate Owner occupancy as specified in SECTION 01 11 00 - SUMMARY OF WORK.

1.3 MEETINGS

A. In addition to progress meetings specified in SECTION 01 31 19 - PROJECT MEETINGS, hold coordination meetings and pre-installation conferences with personnel and subcontractors to ensure coordination of work.

1.4 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals specified in SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Coordinate work of various sections having interdependent responsibilities for equipment, such as installing, connecting to and placing in service.

C. Coordinate requests for substitutions to ensure compatibility of space, of operating elements and effect on work of other sections.

1.5 COORDINATION OF SPACE

A. Coordinate use of project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on drawings. Follow routings shown for pipes, ducts and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance and for repairs.

B. In finished areas, except as otherwise shown, conceal pipes, ducts and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

1.6 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and cleanup of work of separate sections in preparation for substantial completion of portions of work designated for Owner partial occupancy.

B. After Owner occupancy of premises, coordinate access to site by various sections for correction of defective work and work not in accordance with contract documents, to minimize disruption of Owner's activities.

C. Assemble and coordinate closeout submittals specified in SECTION 01 77 00 - CLOSEOUT PROCEDURES.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Scheduling and administration of progress meetings.
   2. Pre-installation conferences.

B. Related Requirements:
   1. Section 01 31 00 - Project Management and Coordination.
   2. Section 01 31 20 - Preconstruction Meetings: Owner's preconstruction conference and pre-mobilization conference.
   3. Section 01 32 16 - Construction Progress Schedules.
   4. Section 01 33 23 - Shop Drawings, Product Data and Samples.
   5. Section 01 45 00 - Quality Control.
   6. Section 01 78 23 - Operation and Maintenance Data.
   7. Section 01 78 39 - Project Record Documents.

1.2 PROGRESS MEETINGS

A. The Architect will schedule and administer monthly construction progress meetings, throughout progress of work. He will prepare agenda and distribute notice of each meeting to participants

B. Contractor shall make physical arrangements.

C. Architect will preside at meetings.

D. Location of Meetings: Contractor's field office.

E. Attendance: Contractor, job superintendent, and Architect. Owner and professional consultants will attend as appropriate. Subcontractors and suppliers shall attend as Architect sees necessary to agenda.

F. Anticipated Agenda:
   1. Review of Contractor's updated Construction Schedule.
   2. Review of work in-progress.
   3. Field observations, problems and decisions.
   4. Identification of problems which impede planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to work.

1.3 PRE-INSTALLATION CONFERENCES

A. When required in individual specification section, convene a pre-installation conference at work site prior to commencing work of the section.

B. Require attendance of entities directly affecting, or affected by, work of the section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda, preside at conference, record minutes and distribute copies within two days after conference to participants, with two copies to Architect.
E. Review conditions of installation, preparation and installation procedures and coordination with related work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 31 19.13

PRECONSTRUCTION

MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Contractor participation in preconstruction meetings.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Administrative provisions.
2. Section 01 31 00 - Project Management and Coordination.
3. Section 01 31 19 - Project Meetings.

1.2 PRECONSTRUCTION MEETING

A. Architect will schedule meeting within 15 days after notice of award.

B. Attendance: Owner, Architect, Construction Manager, General Contractor and representatives of major subcontractors.

C. Agenda
1. Submittal of executed bonds and insurance certificates.
2. Execution of Owner-Contractor Agreement.
3. Distribution of Contract Documents.
4. Submittal of list of subcontractors, list of products, schedule of values and progress schedule.
5. Designation of responsible personnel.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal requests, change orders, allowances and Contract closeout procedures.
7. Scheduling.
8. Use of premises by Owner and Contractor.
9. Owner's requirements and occupancy.
10. Temporary facilities.
11. Survey and building layout.
12. Security and housekeeping procedures.
13. Procedures for testing.
14. Procedures for maintaining record documents.
15. Requirements for startup of equipment.
16. Accessibility Issues.
17. Inspection and acceptance of equipment put into service during construction period.
18. Notice to proceed.
19. Color samples.
20. Procedures for site meetings.
21. Site access and security.
22. Procedures and processing of TEA “Certification of Project Compliance” form.
23. Substantial and final project completion procedures.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Procedures for preparation and submittal of digital construction progress schedules and periodical updating.

B. Related Requirements:
1. Section 01 21 00 - Allowances.
2. Section 01 33 23 - Shop Drawings, Product Data and Samples.
3. Section 01 29 00 - Payment Procedures: Schedule of Values.

1.2 SUBMITTALS

A. Within 21 days of the contract date, Contractor shall prepare and submit a digital Critical Path construction schedule for the work. After review, resubmit required revised data within 5 days.

B. Submit revised digital Critical Path Construction Schedule monthly with each Application for Payment.

C. Submit under transmittal letter specified in SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1.3 WORK SCHEDULE FORMAT

A. The schedule shall not exceed time limits current under the Contract Documents and shall be subject to the approval of the Architect. The Contractor shall prosecute the work vigorously and make every effort to start and complete each phase of the work on or before the dates stated.

B. Should actual construction of project vary from the Critical Path schedule, Contractor shall take whatever actions are necessary to improve progress as quickly as possible in order to meet pre-determined milestones. Revise and re-submit schedule not less than every 30 calendar days. Presentation of the existing or updated Critical Path schedule, in three copies, along with the Certificate of Payment Request shall be a prerequisite to the monthly review of the payment request by the Architect's representative.

C. Sequence of Listings: The chronological order of the start of each item of work.

D. Scale and Spacing: To provide space for notations and revisions.

E. Sheet Size: Minimum 11" x 17".

1.4 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by major specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules for each stage of work identified in SECTION 01 11 00 - SUMMARY OF WORK.

E. Provide sub-schedules to define critical portions of entire schedule.

F. Show accumulated percentage of completion of each item, and total percentage of work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data and samples, including Owner furnished products and products specified under Allowances, and dates reviewed submittals will be required from Architect. Show decision dates for selection of finishes.

H. Show delivery dates for Owner furnished products and products specified under Allowances.

I. Coordinate content with SECTION 01 29 00 - PAYMENT PROCEDURES, Schedule of Values.

1.5 REVISIONS TO SCHEDULES

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays and impact on Schedule. Report corrective action taken, or proposed and its effect.

1.6 DISTRIBUTION

A. Distribute copies of reviewed schedules to job site file, subcontractors, suppliers and other concerned entities.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Digital submission of shop drawings.

B. Related Requirements:
1. General Conditions of the Contract for Construction: Definitions and basic responsibilities of entities.
2. Section 01 31 00 - Project Management and Coordination: Coordination of submittals.
3. Section 01 32 16 - Construction Progress Schedules: Schedules for submittals.
4. Section 01 45 00 - Quality Control: Mockups and samples for testing.
5. Section 01 50 00 - Temporary Facilities and Controls: Project management software.
6. Section 01 62 00 - Product Options.
7. Section 01 78 23 - Operation and Maintenance Data.
8. Section 01 78 39 - Project Record Documents.

1.2 GENERAL

A. Refer to General Conditions, Paragraph 3.12 (Shop Drawings, Product Data and Samples).

B. Digital Submittals: Submit to the Architect, or applicable consultant, shop drawings, product data, and samples required by specification sections. Do not submit illegible fax copies nor carbon copies of shop drawings and product data.
1. Contractor to secure and Submit using the Contractor’s web-based project management program (Procore, Submittal Exchange, Build, etc.). Prepare submittals as .pdf files, with a single file for each submittal, and upload to the Contractor’s project management program (Procore, Submittal Exchange, Build, etc.). Enter required data in program to fully identify submittal in accordance with the required submittal numbering format.

C. Within 30 days of the contract date Contractor shall prepare and submit with the Schedule of Values a comprehensive list of shop drawings, product data and samples. This list shall include products which are proposed for substitution. Also include the estimated date of each submittal and anticipated date of submittal return. Allow the Architect reasonable time to review submittals.
1. The list shall be compiled and submitted using the “Submittal” feature in the Contractor’s project management program (Procore, Submittal Exchange, Build, etc.).

D. Prepare list on basis of each specification section.

E. For products specified under reference standards, include with listing of each product:
1. Name and address of manufacturer.
2. Trade name.
3. Model or catalog designation.
4. Manufacturer's data, including performance and test data, reference standards.

1.3 SHOP DRAWINGS

A. Prepared by a qualified detailer. Prepare project-specific information, drawn accurately to scale. Do not base shop drawings on reproductions of the contract documents or standard printed data. Include supplier’s / detailer’s / manufacturer's title block.

B. Identify details by reference to sheet and detail numbers shown on Contract Documents.

C. Present in a clear and thorough manner original drawings which illustrate the portion of the work

showing fabrication, layout, setting, or erection details, prepared by a qualified detailer. Title each drawing with Project and Contract name and number; identify each element of drawings by reference to sheet number and detail, schedule, or room number of Contract Documents.

1.4 PRODUCT DATA

A. Manufacturer's standard schematic drawings and diagrams:
   1. Modify drawings to delete information which is not applicable to the work.
   2. Supplement standard information to provide additional information specifically applicable to the work.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data:
   1. Clearly mark each copy to identify pertinent materials, products or models.
   2. Show dimensions and clearances required.
   3. Show performance characteristics and capacities.
   4. Show wiring or piping diagrams and controls.

C. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to specification section and Article number. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

1.5 SAMPLES

A. Office samples shall be of sufficient size and quantity to clearly illustrate:
   1. Functional characteristics of product or material, with integrally related parts and attachment devices.
   2. Full range of color samples.

B. Color Selections & Samples: Provide two (2) samples for the Architect’s review and record. Provide cut sheet when applicable.
   1. Samples for Initial Selection: Submit one (1) full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer’s product line. Architect will return submittal with options selected. In addition to the physical samples required above, submit a .pdf file of photographs of the actual color samples and identifying labels.
   2. Samples for Verification: Submit two (2) full-size units or Sample of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection. In addition to the physical samples required above, submit a .pdf file of photographs of the actual color samples and identifying labels. Architect will retain physical samples.
      a. After Color Board has been delivered to the project site, submit one (1) sample for verification in lieu of two (2). One will be retained by Contractor for mounting on Color Board after approval by Architect.

C. Field Samples and Mock-ups:
   1. Erect at project site at location acceptable to Architect.
   2. Construct each sample or mock-up complete, including work of all trades required in finish work.
   3. Install each sample complete and finished. Acceptable finishes in place may be retained in completed work.

D. Digital Samples: In addition to the physical Office Samples and Field Samples/Mock-ups, submit a .pdf file of photographs of the actual samples/mock-ups.

E. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures and patterns, for Architect selection.

F. Submit samples to illustrate functional characteristics of products, including parts and attachments.

G. Approved samples which may be used in the work are indicated in the specification section.

H. Label each sample with identification required for transmittal letter.

1.6 CONTRACTOR REVIEW

A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, quantities and details, manufacturer's catalog numbers and conformance of submittal with requirements of Contract Documents.

B. Coordinate submittals with requirements of work and of Contract Documents.

C. Sign or initial in a rubber-stamped review block format, each sheet of shop drawings and product data and each sample label to certify compliance with requirements of Contract Documents. Notify Architect in writing at time of submittal, of any deviations from requirements of Contract Documents.

D. Do not fabricate products or begin work which requires submittals until return of submittal with Architect acceptance.

E. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect's review of submittals.

F. Contractor's responsibility for deviations in submittals from requirements of contract documents is not relieved by Architect's review of submittals, unless Architect gives specific written acceptance of deviations. Architect will review submittals for general conformance to design intent only.

1.7 SUBMISSION REQUIREMENTS

A. Submit Shop Drawings and Product Data as soon as practicable after award of contract but not later than 30 calendar days before dates reviewed submittals will be needed.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Resubmittal Review: Allow 10 working days for review of each resubmittal.

C. Submit all office samples as soon as practicable but not later than 60 days after award of contract in order to facilitate color selections and coordination of the various materials. Final color selections and release of shop drawings contingent upon color selection will not be made until all office samples have been submitted, coordinated and approved.
   1. Color Board shall be delivered to the project site after 60 days. Contractor is responsible for updating color board with samples submitted by Contractor and approved by Architect after 60 days.

D. Digital Submittals: Submit to the Architect, or applicable consultant, shop drawings, product

data, and samples required by specification sections. Do not submit illegible fax copies nor carbon copies of shop drawings and product data.

1. The submittals shall be logged in by the General Contractor and tracked using the “Submittal” feature in the Contractor’s project management program (Procore, Submittal Exchange, Build, etc.). All submittals shall be submitted in .pdf format.
   a. Submittals 8-1/2" x 11" and/or 11" x 17" and greater than 50 pages: Provide digital copy for the Architect’s records.
   b. Large Format Drawings (larger than 11 x 17): Provide digital copy for the Architect’s records.
2. Architect will indicate, via markup on each digital submittal, the appropriate action, then return submittal via the Contractor’s project management program (Procore, Submittal Exchange, Build, etc.).
3. Submittals to be reviewed by consultants shall be submitted directly to the applicable consultant via (Procore, Submittal Exchange, Build, etc.) with a copy simultaneously sent to the Architect. Submittals will be reviewed by the consultant and then delivered/transmitted to the Architect for his review prior to transmitting them to the contractor. Submittals to be reviewed by the testing lab shall be handled in the same manner.
4. Color Selections & Samples: Reference “Samples” Article within this specification section.

E. Submittals to be reviewed by consultants shall be submitted directly to the applicable consultant with a copy of only the digital transmittal simultaneously copied to the Architect. Submittals will be reviewed by the consultant and then delivered/transmitted to the Architect for his review prior to transmitting them to the contractor. Submittals to be reviewed by the testing lab shall be handled in the same manner. Reference SHOP DRAWINGS Paragraph, PRODUCT DATA Paragraph, and SAMPLES Paragraph within this specification section for submittal quantity requirements.

F. Contractor is responsible for the costs associated with the digital delivery of all submittals, and hard copy where required, to the Architect and the Architect's consultants and retrieval of all submittals from the Architect, when necessary.

G. Accompany submittals with transmittal letter containing:
   1. Date.
   2. Project title and number.
   3. Contractor's name and address.
   4. Identification of specification section and submittal numbers.
   5. The number of each shop drawing, product data and sample submitted.
   6. Notification of deviations from contract documents.
   7. Other pertinent data.

H. Submittals shall include:
   1. Date and revision dates.
   2. Project title and number.
   3. Names of Architect, Contractor, subcontractor, supplier and manufacturer.
   4. Identification of product or material and specification section number.
   5. Relation to adjacent structure, materials or other critical features.
   6. Field dimensions, clearly identified as such.
   7. Applicable reference standards.
   8. A blank space 3" x 4" for Architect's stamp.
   9. Identification of deviations from contract documents.
   10. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements, compliance with contract documents and coordination with requirements of the work. Note: Absence of the Contractor's stamp shall constitute grounds for rejection of the submittal until such time as the submittal has been processed in accordance with this requirement.
   11. Other pertinent data required by specifications.

1.8 RE-SUBMISSION REQUIREMENTS

A. Re-submission: For shop drawings and product data not approved by Architect, make corrections and changes in submittals required by Architect and re-submit until approved.
   1. The digital re-submission shall be logged in using the “Resubmit” feature in the

Contractor's project management program (Procore, Submittal Exchange, Build, etc.).

B. Shop Drawings:
   1. Revise initial drawings and re-submit as specified for initial submittal.
   2. Indicate on drawings any changes which have been made, other than those requested by Architect.

C. Product Data and Samples: Submit new data and samples as specified for initial submittal

1.9 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

A. Distribute reviewed copies of shop drawings and product data which carry Architect's stamp as follows: Contractor's file, project site file, record documents file, other prime contractors.

B. Keep and maintain a full set of submittals throughout the construction phase to be submitted to the Architect with other Close-out documents for delivery to the Owner for his permanent record. Set of submittals shall be delivered to the Architect in cardboard file boxes with string and button type closures. Organize submittals by CSI divisions, utilizing neatly labeled pressboard dividers to separate the sections. Neatly label short end of box with project name, contents and duration of construction.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 41 00

REGULATORY

REQUIREMENTS

PART 1 - GENERAL

1.1 CODES

A. Where references are made on drawings or specifications to codes, they shall be considered an integral part of the contract documents as minimum standards. Nothing contained in the contract documents shall be so construed as to be in conflict with any law, bylaw or regulation of the municipal, state, federal or other authorities having jurisdiction.

B. Perform work in compliance with all City of El Paso ordinances and requirements.

1.2 GOVERNING LAWS

A. Additional information with legal implications regarding applicable governing laws and jurisdictions can be found in the conditions of the contract.

1.3 PERMITTING

A. Contractor shall, without additional expense to Owner, obtain necessary licenses and permits, and be responsible for complying with any federal, state, county and municipal laws, codes and regulations applicable to the performance of the work, including, but not limited to, any laws or regulations requiring the use of licensed contractors to perform parts of the work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the contract documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the contract documents to the extent referenced. Such standards are made a part of the contract documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the contract documents.

C. Copies of Standards: Each entity engaged in construction on project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the contract documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	800.872.2253 202.272.0080
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterway Experiment Station http://www.erdc.usace.army.mil/	601.634.2355
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point www.dodssp.daps.dla.mil	215.697.6257
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point www.dodssp.daps.dla.mil	215.697.6257
	Available from General Services Administration www.gsa.gov	202.501.1021
	Available from National Institute of Building Sciences www.nibs.org	202.289.7800
ICC-ES	ICC Evaluation Services, Inc. www.icc-es.org	800.423.6587 562.699.0543

MIL	See MILSPEC	
MIL-STD	See MILSPEC	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point www.dodssp.daps.dla.mil	215.697.6257
TAS	Texas Accessibility Standards P.O. Box 12157 Austin, TX 78711 www.license.state.tx.us/ab/abtas.htm	512.463.3211

1.2 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	703.358.2960
AAMA	American Architectural Manufacturers Association www.aamanet.org	847.303.5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	202.624.5800
ACI	ACI International (American Concrete Institute) www.aci-int.org (www.concrete.org)	248.848.3700
AGA	American Gas Association www.aga.org	202.824.7000
AISC	American Institute of Steel Construction www.aisc.org	800.644.2400 312.670.2400
AISI	American Iron and Steel Institute www.steel.org	202.452.7100
ANSI	American National Standards Institute www.ansi.org	202.293.8020
APA	APA-The Engineered Wood Association www.apawood.org	253.565.6600
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers www.ashrae.org	404.636.8400
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	610.832.9585

AWPA	American Wood Protection Association www.awpa.com	205.733.4077
AWS	American Welding Society www.aws.org	800.443.9353 305.443.9353
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	212.297.2122
BIA	Brick Industry Association (The) www.gobrick.com	703.620.0010
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	630.584.1919
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	301.596.2583
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	847.517.1200
DHI	Door and Hardware Institute www.dhi.org	703.222.2010
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	401.275.3000
GA	Gypsum Association www.gypsum.org	301.277.8686
GANA	Glass Association of North America www.glasswebsite.com	785.271.0208
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	703.435.2900
IGCC	Insulating Glass Certification Council www.igcc.org	315.646.2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	613.233.1510
MBMA	Metal Building Manufacturers Association www.mbma.com	216.241.7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	888.480.9138

MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	312.644.6610
MIA	Marble Institute of America www.marble-institute.com	440.250.9222
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	630.942.6591
NCMA	National Concrete Masonry Association www.ncma.org	703.713.1900
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	207.829.6901
NEMA	National Electrical Manufacturers Association www.nema.org	703.841.3200
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	800.344-3555 617.770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	301.589.1776
NHLA	National Hardwood Lumber Association www.nhla.com	800.933.0318 901.377.1818
NLGA	National Lumber Grades Authority www.nlga.org	604.524.2393
NOFMA	National Oak Flooring Manufacturers Association (The Wood Flooring Manufacturers Association) www.nofma.org	901.526.5016
NRCA	National Roofing Contractors Association www.nrca.net	800.323.9545 847.299.9070
NTMA	National Terrazzo & Mosaic Association, Inc. www.ntma.com	800.323.9736 540.751.0930
NWWDA	National Wood Window and Door Association (See WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	312.786.0300
PDCA	Painting and Decorating Contractors of America www.pdca.org	800.332.7322 314.514.7322
SDI	Steel Deck Institute www.sdi.org	847.458.4647
SDI	Steel Door Institute www.steeldoor.org	440.899.0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	516.294.5424

SGCC	Safety Glazing Certification Council www.sgcc.org	315.646.2234
SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	843.626.1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	703.803.2980
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	850.434.2611
TCNA	Tile Council of America, Inc. www.tileusa.com	864.646.8453
TPI	Truss Plate Institute, Inc. www.tpinst.org	703.683.1010
UL	Underwriters Laboratories Inc. www.ul.com	800.285.4476 847.272.8800
USGBC	U.S. Green Building Council www.usgbc.org	800.795.1747 202.828.7422
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	800.283.1486 503.639.0651
WDMA	Window & Door Manufacturers Association (Formerly: NWWA - National Wood Window and Door Association) www.wdma.com	800.223.2301 312.321.6802
WI	Woodwork Institute (Formerly AWI - Architectural Woodwork Institute) www.woodworkinstitute.com	916.372.9943
WWPA	Western Wood Products Association www.wwpa.org	503.224.3930

A. Code Agencies: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

BOCA	BOCA International, Inc. (See ICC)	
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	909.472.4100

ICBO	International Conference of Building Officials (See ICC)	
ICC	International Code Council (Formerly: CABO - Council of American Building Officials) www.iccsafe.org	888.422.7233 703.931.4533
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	

B. Federal Government Agencies: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	800.638.2772 301.504.6816
EPA	Environmental Protection Agency www.epa.gov	202.272.0167
OSHA	Occupational Safety & Health Administration 2 www.osha.gov 9	800.321.674 202.693.199

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 42 16

DEFINITIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. “Furnish": Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.

B. "Install": Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

C. "Product": Materials, systems and equipment.

D. “Project Manual”: Volume assembled for the Work which may include the bidding requirements, sample forms, conditions of the contract, and specifications.

E. "Provide": Furnish and install, complete and ready for the intended use.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Quality control of products and workmanship.
2. Manufacturer's instructions.
3. Manufacturer's certificates and field services.
4. Mockups.

B. Related Requirements:
1. Section 01 33 23 - Shop Drawings, Product Data, and Samples: Field samples. Submittal of manufacturer's instructions.
2. Section 01 42 00 - References.
3. Section 01 45 23 - Testing and Inspection Services.
4. Section 01 62 00 - Product Options.
5. Individual Specifications Sections: Mockups required.

1.2 DESCRIPTION

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, workmanship, and site conditions, to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards of the region except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Provide suitably qualified personnel to produce work of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

D. Provide finishes to match approved samples.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Require compliance with instructions in full detail, including each step in sequence.

B. Should instruction conflict with contract documents, request clarification from Architect/Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specifications section, submit manufacturer's certificate, in duplicate, certifying that products meet or exceed specified requirements, executed by responsible officer.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specifications section, have manufacturer or his authorized representative provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment test, adjust, and

balance of equipment as applicable, and to make written report of observations and recommendations to Architect.

B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 30 days of observation to Architect/Engineer for review.

1.7 MOCKUPS

A. Tests will be performed under provisions of SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

B. Assemble and erect complete, with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Acceptable mockups in place may be retained in completed work.

1.8 FIELD SAMPLES

A. Install field samples at the site as required by individual specification sections for review.

B. Acceptable samples represent a quality level for the work.

C. Where field sample is specified in individual sections to be removed, clear area after field sample has been accepted by Architect/Engineer.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 45 23

TESTING AND INSPECTION SERVICES (BY OWNER)

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included: Owner provided materials testing laboratory services.

B. Related Requirements:
   1. Document 00 31 32 - Geotechnical Data.
   2. Terms and Conditions: Inspections, testing, and approvals required by public authorities.
   3. Section 01 45 00 - Contract Quality Control: Manufacturer's certificates.
   4. Section 01 78 39 - Project Record Documents.
   5. Individual Specifications Sections: Inspections and tests required, and standards for testing.

1.2 SELECTION AND PAYMENT

A. Owner will employ services of an independent materials testing laboratory to perform specified inspection and testing and will pay for these services directly to the testing laboratory.

B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of contract documents. Contractor will pay all testing required by local authorities having jurisdiction.

1.3 QUALITY ASSURANCE

A. Laboratory shall comply with requirements of ASTM E 329 and ASTM D 3740 and provide certifications to this effect.

B. Laboratory shall maintain a full-time registered Engineer on staff to review specific tests required by this specification.

C. Laboratory shall be authorized to operate in State in which project is located.

D. Testing equipment shall be calibrated to ensure accurate results and values in order to ensure that test results are true and valid, and at intervals with devices of an accuracy traceable to either NBS Standards or accepted values of natural physical constants.

1.4 LABORATORY RESPONSIBILITIES

A. Provide qualified personnel at site after due notice from the contractor; cooperate with Architect, Contractor, and appropriate public authorities having jurisdiction in performance of services.

B. Perform specified inspection, sampling, and testing of products in accordance with latest, up-to-date standards.

C. Ascertain compliance of materials and mixes with requirements of contract documents.

D. Promptly notify Architect, appropriate consultants, Contractor, Owner, and authority having jurisdiction of observed irregularities or non-conformance of work or products.

E. Perform additional inspections and tests required by Architect, Owner, Contractor, or authority having jurisdiction.

1.5 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to Architect, one to applicable consultant, one to Owner, one to Contractor, and one to City. Include: Date issued, project title and number, name of inspector, date and time of sampling or inspection, weather conditions, identification of product and specifications section, location in the project, type of inspection or test, date of test, results of tests, and specific indication of conformance, or lack of such, with contract documents. When requested by Architect/Engineer, provide interpretation of test results.

1.6 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of contract documents.

B. Laboratory may not approve or accept any portion of the work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop work.

1.7 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing, together with proposed mix designs.

B. Cooperate with laboratory personnel, and ensure ready access to work and to manufacturer's facilities, if requested by testing lab.

C. Provide incidental labor and facilities for access to work to be tested, to obtain and handle samples at the site, or at source of products to be tested, in order to facilitate tests and inspections, and for storage and curing of test samples.

D. Notify laboratory of material sources and furnish lab-determined necessary quantities of representative samples of materials proposed for use which are required to be tested.

E. Notify Architect and laboratory 24 hours prior to expected time for operations requiring inspection and testing services. Cancel notifications in a timely manner if items or systems are not ready for inspection as intended. Reimburse Owner for trip charges when cancellation notifications are not made in a timely fashion.

F. Advise laboratory in a timely fashion to complete required inspection and testing prior to subsequent work being performed.

G. Reimburse Owner for all subsequent re-testing of products or systems found to be defective or otherwise not in accordance with specification requirements, and for any overtime pay required as a result of any inspection requirements that may fall outside of normal job-site weekday work schedule. Remove rejected products or work and replace with products or work of specified quality.

H. Notification of Source Change: The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and testing laboratory when the source of any material is changed after the original tests or inspections have been made.

PART 2 - PRODUCTS – Not used.

PART 3 - EXECUTION

3.1 BUILDING SUBGRADE PREPARATION

A. Make necessary soil tests (Atterberg Limit Series and ASTM D 698 Standard Proctor for each type of fill) to determine the moisture content and density of existing subgrade and inspect and test the placement of additional fill lifts to verify that all fill materials used are in accordance with the specifications for that use. Perform one field density test (ASTM D 2922 and ASTM D 3017) for each 5,000 sq.ft. of area within the building footprint on each lift prior to placement of additional fill material.

3.2 DRILLED CONCRETE PIERS

A. The independent testing laboratory shall provide the services of their registered geotechnical engineer at the initiation of the on-site pier drilling operations to determine the appropriate bearing material into which the piers are to be founded. Written documentation of the "determination" shall be prepared and forwarded to the Owner, Architect, and Contractor.

B. Make on-site full-time inspections of the pier drilling operation for each pier drilled and placed to verify that the proper strata and penetration, or depth, has been attained, and determine that shafts are properly clean and dry before placing concrete.

C. Maintain a pier log for each pier showing design requirements and actual in place size and depth, in accordance with example noted in Specification SECTION 31 63 29 - DRILLED CONCRETE PIERS.

D. Verify that the excavation is of the proper size and adequately clean and dry.

E. Verify that each shaft is founded at a depth in accordance with the geotechnical report, existing on-site conditions that may be encountered, and at the proper bearing strata.

F. Verify that the reinforcing steel and concrete are properly placed in accordance with other testing provisions specified herein.

G. Notify the Architect and Contractor if soil or water conditions may require casing of piers.

H. Inspection reports of pier drilling shall contain the following:
   1. Pier Mark.
   2. Pier Depth.
   3. Depth of penetration into bearing strata.
   4. Plumbness deviation.
   5. Description of unusual conditions encountered, including groundwater.
   6. Record of deviations from contract document requirements.
   7. Other requirements, as defined in SECTION 31 63 29 - DRILLED CONCRETE PIERS.

3.3 FORMWORK, REINFORCING STEEL AND INSERTS

A. Make general inspection of formwork.

B. Prior to each concrete pour, inspect fabrication and bending of bars, bar sizes, spacing, placement and tying in accordance with ACI 315.

C. Prior to each concrete pour, inspect positioning of steel inserts and assemblies, sizes, and spacing, and inspect fusion-welded anchors and sheer connectors.

3.4 CAST-IN-PLACE CONCRETE

A. Design Mixes:
   1. At the beginning of the work, Contractor shall submit proposed concrete mixes for review by the Architect, structural engineering consultant, and testing laboratory, including the sieve analysis of fine and course aggregate ASTM C 136, dry rodded weight of coarse aggregate -

ASTM C 29, and the specific gravity (bulk saturated surface dry), of fine and coarse aggregates ASTM C 127 and C 128.

2. The testing laboratory will submit their findings to the structural consultant, who will subsequently forward this information, with their review of the submittals, to the Architect.
3. Contractor shall not mix concrete for placing in the work until confirmation laboratory reports are supplied to reflect that each proposed mix will develop the strength required. Successful past history in accordance with ACI 318 will be satisfactory.

B. Test Cylinders: Make at least one test of each day's pouring of concrete or each 100 cubic yards, whichever is the least, on each different portion or section of the work. Mold and cure specimens in accordance with ASTM C 31, and test in accordance with ASTM C 39. Test cylinders shall be made and tested by the laboratory. Footings, walls, and floor systems constitute different sections. Each test shall consist of four specimens, one of which shall be broken at seven days, two at 28 days and one held in reserve. Determine temperature and air content for each set of test cylinders in accordance with ASTM C 231.

C. Field Quality Control:
1. Determine slump for each concrete strength test and whenever consistency of concrete varies, in accordance with ASTM C 143.
2. Monitor and record addition of water to concrete and length of time concrete is allowed to remain in truck.
3. Verify delivery tickets indicating class of concrete, amount of water added during initial batching, and time initial batching occurred.
4. Monitor work being performed in accordance with ACI (American Concrete Institute) recommendations as a standard of quality.
5. Reference SECTION 03 30 00 - CAST-IN-PLACE CONCRETE for additional requirements.

D. Source Quality Control: An independent testing laboratory representative shall periodically inspect and control concrete mixing and loading of transit mix trucks at batch plant at intervals appropriate to monitor quality of material issued on job.

3.5 STRUCTURAL STEEL

A. Fabrication of, erection of, and connections between, structural steel members, including welding and tension in high strength bolts, will be accomplished under and subject to the inspection of an independent testing agency. The general contractor, structural steel fabricator, and erector shall afford full cooperation to the laboratory.

B. Perform the following testing and inspection: (Prior to placement of steel deck)
1. Check location of condition of anchor bolts.
2. Check plumbness and tolerance of steel frame.
3. Qualification of welders and welding techniques (at Contractor's expense).
4. Visually inspect common bolts.
5. Inspection of high-strength bolting:
   a. Visually inspect connections.
   b. Check tightness of at least 33% of connections.
   c. Check at least two bolts of each girder to column connection.
6. Visually inspect field and shop welds.
7. Ultrasonic or X-ray testing of full penetration welds.
8. Re-inspect corrective measures required at expense of Contractor.
9. Verify that no members are damaged.
10. Verify that materials and installation are according to contract documents and industry standards.

C. Gas Cutting: Do not use gas cutting torches for correcting fabrication errors in the structural framing. Cutting will not be permitted on any member, unless specifically approved by the structural engineer. Finish gas-cut sections equal to a sheared appearance when gas finish cutting is permitted. Do not flame cut holes or enlarge holes by burning.

D. Correction: The fabricator or erector shall correct deficiencies in structural steel work which

inspection and test reports have indicated to be not in compliance with the specified requirements. Perform all additional tests required to reconfirm non-compliance of the original work and to show compliance of corrected work. Retesting of non-conforming work shall be paid by the Contractor.

E. All welders employed during erection of structural steel must be certified by The American Welding Society for type of base materials and positions encountered. Certification testing to be performed at Contractor's expense and copies of Certifications shall be submitted for review upon request and maintained at the project site by the Contractor.

3.6 STEEL JOISTS

A. All steel joists and connections to structural steel members shall be inspected.

B. Quality Assurance: All welding performed during the manufacture and erection of steel joists shall comply with the requirements of AWS D1.1.

C. Inspect condition of joists after erection; check method of attachment to structures and details of bridging and accessories to verify compliance with required standards.

3.7 METAL DECKING

A. Qualification of Welders: Qualify the welding process and all welders (at Contractor expense), and periodically monitor the work in accordance with the requirements of AWS D1.3.

B. Testing Laboratory shall inspect steel decking to ensure the material and installation is in accordance with the specifications and shop drawings.

3.8 METAL DECK AND FIELD WELDED SHEAR STUDS:

A. The erection of metal deck and field welded shear studs shall be subject to inspection by the testing agency.

B. Shear Studs:
   1. Test minimum of two shear studs welded at start of each production period in order to determine generator, control unit and stud welder setting. Studs shall be capable of being bent 45° from vertical without weld failure. If, after welding, visual inspection reveals that sound weld or a full 360° fillet has not been attained for a particular stud, such stud shall be struck with hammer and bent 15° off perpendicular to nearest end of beam. Studs failing under this test shall be replaced.
   2. When the temperature is below 32°F., two studs from each group of 100 studs (or one stud if less than 100 studs are present) should be tested after cooling. Studs shall not be welded below 0°F. or when surfaces are wet with rain or snow. If stud fails in weld, two new studs shall pass test before resumption of welding.

3.9 CEMENTITIOUS FIREPROOFING

A. Application inspection to ensure the material and installation is in accordance with the specifications.

B. Sample and verify the thickness and density of spray applied fireproofing in accordance with ASTM E 605 for each days application.

3.10 SMOKE TEST OF DRAINAGE AND VENT PIPING

A. Test to check for joint leakage in the sanitary sewer system and vent system.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 GENERAL

A. Provide temporary facilities and controls needed for the work including, but not limited to those described in the Articles below.

B. Maintain temporary facilities and controls as long as needed for safe and proper completion of the work.

1.2 ACCESS

A. Provide adequate access to and temporary roads to the site of the building if required for the prosecution of the work.

B. Provide and maintain access to fire hydrants, free of obstructions.

1.3 FIELD OFFICE

A. Provide and maintain a weathertight temporary field office equipped with adequate illumination; with smooth tables for perusal of drawings and specifications. During cold weather the field offices shall be equipped with a heating device to maintain 65°F. temperature during the work day. During hot weather the offices shall be equipped with an air conditioning device to maintain temperature below 80°F. Provide and pay for fuel and electric energy. In addition to the above listed equipment, provide a space to accommodate the site meetings and have a layout/conference table at 28" height and chairs for 12 people. Upon completion of the project, remove offices from the premises.

1.4 TELEPHONES AND ELECTRONIC COMMUNICATION SERVICE

A. Provide telephones/mobile phones in the field office. Telephone shall be in operation from the commencement of work until the acceptance of the building. Contractor shall pay for installation, maintenance, and removal of telephone and for all use charges.

B. Electronic Communication Service: Provide a computer, printer, high-speed data connection, and internet service as required for the Contractor to maintain internet access and e-mail correspondence.
   1. The Contractor shall secure as part of the project, a project management system such as Procore, Submittal Exchange, Autodesk Build, etc., which access shall be shared with the Owner and Architect. Contractor shall utilize this system for all formal and informal correspondence with the Architect and Architect's Consultants, including E-Mails, Requests for Information, Proposals, Submittals, Submittal Transmittals, Meeting Minutes (for regularly scheduled meetings), and Warranty Responses (if warranty items are submitted in the system). In addition, Subcontractor Lists, Project Schedules, Schedule of Values and other documents requiring submission shall be uploaded in pdf, Word, or Excel format by the Contractor to the appropriate location in the Online Software. At the Contractor's option, Pay Applications, Project Schedules, and Transmittals, may be created or imported into the system, as well.
   2. While the project management system is very user friendly and easy to learn, Architect will provide informal training for the Contractor as necessary to expedite the Contractor's familiarity with the program.

3. Contractor shall pay for installation, maintenance, and removal of high-speed data connection and for all use charges.

1.5 TEMPORARY ELECTRICAL SERVICE

A. The contractor shall provide, install, and maintain separate temporary electrical service, including a separate temporary electric meter and temporary pole, if required. The contractor shall be responsible for contacting and coordinating with the local utility company for the installation, maintenance and removal of the temporary service. The contractor shall pay for all costs associated with this separate temporary electrical service.

B. Provide and maintain temporary electric power to points in the building convenient for and available to all trades, including mechanical and other contracts, so that power can be secured anywhere in the building with no more than a 100 ft. extension cord. Energy charges shall be paid by the Contractor**.**

1.6 TEMPORARY LIGHTING

A. Provide and maintain temporary lighting inside the building for safe and adequate working conditions throughout all areas where work of any kind is being performed. Provide at least 1/2 watt of incandescent lighting for each square foot of space. Where practical, place temporary lights in the locations where the permanent lighting fixtures are to be installed.

1.7 TEMPORARY HEAT

A. Provide necessary heat during the course of construction, including equipment, fuel and attendance where required. Equipment for temporary heating shall be of a non-smudging type. The permanent heating system may be used for temporary heat, when installed. Upon completion and before acceptance of the building, Contractor shall repair all damage caused by such temporary use and shall clean all filters.

B. When the outside temperature is below freezing, inside of the building shall be kept at or above 40°F. at all times. While painting and finishing are in progress, the temperature shall be kept at or above 60°F. Contractor shall make good all damage caused by insufficient heat.

1.8 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.9 TEMPORARY WATER SERVICE

A. Provide and maintain a temporary water supply during the course of construction and pay water bill and meter installation or "tap" fee, if any. Include necessary piping and hose connections. Take precautions to avoid spattering and spilling water in the building.

1.10 TEMPORARY SANITARY FACILITIES

A. Provide and maintain adequate sanitary toilet facilities on the project site. The toilet facilities shall meet the requirements of the public authorities having jurisdiction and their use strictly enforced. Sanitary sewer "tap" fee and monthly use fees, if any, shall be paid by Contractor if temporary facilities are connected to city sanitary sewer.

1.11 REFUSE

A. The Contractor shall provide refuse removal service at all times.

1.12 PROTECTIVE FACILITIES

A. Provide and maintain temporary guardrails, handrails and covers for floor, roof and wall openings, vertical shafts and stairways. If movement of the protective facilities is required by a subcontractor to perform his work, it will be the responsibility of that subcontractor to give prior notification to the Contractor and to replace the protective facilities in a satisfactory manner.

B. Provide and maintain, as per City of El Paso requirements, fire lane(s) and other required fire protection at the appropriate time and sequence of construction.

1.13 BARRICADES

A. Provide and maintain lighted barricades and fences for the public protection in accordance with requirements of the local city ordinances.

1.14 TEMPORARY FENCING

A. Provide and maintain for the duration of construction a temporary fence of design and type needed to prevent entry onto the work by the public.

1.15 TEMPORARY FIRE PROTECTION

A. Contractor shall provide adequate fire extinguishers on the premises during the course of construction, of the type and size recommended to control fires, which may result from the particular work being performed in accordance with the local fire marshal and fire codes.

B. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of ignition for possible fires.
   1. Keep work area free of combustible material.
   2. A fire watch consisting of at least one man furnished by Contractor with a fire extinguisher in hand and with no other assigned duties, shall be posted to stand by and observe for potential hazards while welding or cutting is being done. Equip fire watch with suitable personal eye protection and fire extinguishers.
   3. At completion of work operations, immediately inspect work and adjacent area for hazards. Re-inspect work for hazards at 1/2 hour and at one hour after completion of welding and cutting operations.

C. No smoking shall be allowed within the building or on the site. Post NO SMOKING signs in areas where work is in progress.

1.16 ENCLOSURES

A. Provide temporary weathertight closures of openings in exterior surfaces to provide acceptable working conditions and protection for materials, to allow for temporary heating, and to prevent entry of unauthorized persons. Provide doors with self-closing hardware and locks.

B. Provide temporary partitions and ceilings as required to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, to prevent damage to existing areas and equipment. Construction: Framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces; STC rating 35 in accordance with ASTM E 90; flame spread rating of 25 in accordance with ASTM E 84; paint surfaces exposed to view in Owner occupied areas.

1.17 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide and operate pumping equipment.

B. Protect site from puddling or running water.

1.18 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish; periodically dispose of off site.

B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

C. Refer to SECTION 01 74 13 - PROGRESS CLEANING for additional cleaning requirements.

1.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary materials, equipment, services, and construction prior to substantial completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of 2'; grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

1.20 PROJECT IDENTIFICATION SIGNS

A. Furnish and erect a project sign, approximately 4' high by 8' long of 3/4" thick exterior grade plywood, in conformance with sign detail supplied by the Architect. Support on posts of framing of treated wood or steel.

B. Erect sign within 30 days of start of construction and maintain in good condition until completion of project. Sign shall be located as directed by the Architect.

C. No other signs or advertising of any kind, except precautionary warning signs, will be permitted.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 62 00

PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for product options and substitutions.

B. Related Requirements:
1. Section 01 31 00 - Project Management and Coordination: Coordination of construction.
2. Section 01 33 23 - Shop Drawings, Product Data, and Samples: Product data submittals.
3. Section 01 42 00 - References: Applicability of specified reference standards.
4. Section 01 78 23 - Operation and Maintenance Data.
5. Section 01 78 39 - Project Record Documents.

1.2 PRODUCT LIST

A. Within 30 days after date of contract, submit to the Architect a list of products and materials which are proposed for substitution per SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 CONTRACTOR'S OPTIONS

A. For products specified only by reference standards, select any product meeting standards, by any manufacturer.

B. For products specified by naming several products or manufacturers, followed by the words "NO SUBSTITUTIONS", select one of the products/manufacturers named.

C. For products specified by naming only one product and manufacturer, there is no option unless a substitution is approved as specified below.

D. For products specified by naming only one product and manufacturer, followed by the words "NO SUBSTITUTIONS", there is no option.

1.4 SUBSTITUTIONS

A. Requests for substitution to material, products, or equipment instead of those specified will be considered if received at least 10 days prior to the bid date. Substitution request received within 10 days of the bid date will be returned without review. Refer to Substitution Request (During the Bidding Phase) form attached to this section.

B. Within 30 days after Notice to Proceed, Architect will consider additional formal requests from the Contractor for substitutions of products in place of those specified. Refer to Substitution Request (After the Bidding Phase) form attached to this section.

C. Submit a separate request for each substitution on a copy of the "SUBSTITUTION REQUEST" form, attached to this section. Include in request:
1. Complete data substantiating compliance of proposed substitution with contract documents.
2. For products:
   a. Product identification, including manufacturer's name and address.
   b. Manufacturer's literature, including product description, performance and test data and reference standards.
   c. Samples, if applicable.
   d. Name and address of similar projects on which product was used and date of installation.

3. For construction methods:
   a. Detailed written descriptions of proposed method.
   b. Complete drawings illustrating methods or revisions.
4. Itemized Comparison of qualities of proposed substitution with product or method specified.
5. Changes required in other elements of work because of substitution.
6. Effect on construction schedule.

D. Request for substitution constitutes a representation that Contractor:
   1. Has personally investigated proposed product or method and determined that it is equal to or superior in all respects to that specified.
   2. Will provide same warranties for substitution as for product or method specified.
   3. Will coordinate installation of accepted substitution into the work, making such changes as may be required for the work to be complete in all respects.
   4. Waives all claims for additional cost, under his responsibility and related to substitution, which subsequently become apparent.

E. Substitutions will not be considered if:
   1. They are indicated or implied on shop drawings or product data submittals without formal request submitted in accordance with this section.
   2. Acceptance will require substantial revision of contract documents.

F. If substitution is not approved or accepted, Contractor shall furnish specified product or method at no additional cost to the Owner.

G. Acceptance of a proposed substitution prior to the bid date will be in the form of an addendum.

1.5 SUBMITTAL PROCEDURES

A. Submit five copies of request for substitution.

B. Architect will review Contractor's requests for substitutions with reasonable promptness.

C. For accepted products, submit shop drawings, product data, and samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SUBSTITUTION REQUEST
(During the Bidding Phase)
(submit two copies-must be received 10 days prior to bid/proposal date)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, custom color/pre-selected color availability, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E/ design, detailing, and construction costs caused by the sub- situation.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E REVIEW AND ACTION

☐ Substitution approved - Submit bid/proposal based on accepted substitution.

☐ Substitution approved as noted - Submit bid/proposal based on accepted substitution - as noted.

☐ Substitution rejected - Submit bid/proposal for specified materials.

☐ Substitution Request received too late - Submit bid/proposal for specified materials.

Signed by: _____ Date: _____

Supporting Data Attached: □ Drawings □ Product Data □ Samples
□ Tests □ Reports □ ___

SUBSTITUTION REQUEST
(After the Bidding Phase)
(submit five copies - must be received not later than 30 days after Notice to Proceed)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

History: GNew product □ 2-5 years old □ 5-10 years old □ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

For finish materials and pre-finished equipment, list the colors available for the specified item and the colors available for the proposed substitution.

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: □ No □ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: □ No □ Yes [Add] [Deduct] ____

_____days.

Supporting Data Attached: □ Drawings □ Product Data □ Samples
□ Tests □ Reports □ _____

SUBSTITUTION REQUEST - Continued

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to speci- fied product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Section 01 33 23.

☐ Substitution approved as noted - Make submittals in accordance with Section 01 33 23.

☐ Substitution rejected - Use specified materials.

☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

_____

_____

_____

_____

SECTION 01 65 00

PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included:
   1. Packaging, Transportation.
   2. Delivery and Receiving.
   3. Product Handling.

B. Related Requirements:
   1. Section 01 32 16 - Construction Progress Schedules.
   2. Section 01 33 23 - Shop Drawings, Product Data and Samples: Manufacturers' Instructions.
   3. Section 01 66 00 - Product Storage and Handling Requirements.
   4. Individual Sections: Specific requirements for packaging, shipping and handling.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PACKAGING, TRANSPORTATION

A. Require supplier to package products in boxes or crates for protection during shipment, handling and storage. Protect sensitive products against exposure to elements and moisture.

B. Protect sensitive equipment and finishes against impact, abrasion and other damage.

3.2 DELIVERY AND RECEIVING

A. Arrange deliveries of products in accordance with construction progress schedules. Allow time for inspection prior to installation.

B. Coordinate deliveries to avoid conflict with work and conditions at site; limitations on storage space; availability of personnel and handling equipment; and Owner's use of premises.

C. Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.

D. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.

E. Immediately on delivery, inspect shipment to assure
   1. Product complies with requirements of contract documents and reviewed submittals.
   2. Quantities are correct.
   3. Accessories and installation hardware are correct.
   4. Containers and packages are intact and labels legible.
   5. Products are protected and undamaged.

3.3 PRODUCT HANDLING

A. Provide equipment and personnel to handle products by methods to prevent soiling and damage.

B. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging and surrounding surfaces.
C. Handle product by methods to avoid bending or over-stressing. Lift large and heavy components only at designated lift points.

END OF SECTION

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included:
   1. Storage, General.
   2. Enclosed Storage.
   3. Exterior Storage.
   4. Maintenance of Storage.

B. Related Requirements:
   1. Section 01 11 00 - Summary of Work.
   2. Section 01 50 00 - Construction Facilities and Temporary Controls: Storage facilities. Protection of installed work.
   3. Section 01 65 00 - Product Delivery Requirements.
   4. Section 01 78 39 - Project Record Documents.

PART 2 - PRODUCTS - Not used.

PART 3 - EXECUTION

3.1 STORAGE, GENERAL

A. Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.

B. Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

3.2 ENCLOSED STORAGE

A. Store products, subject to damage by the elements, in substantial weathertight enclosures.

B. Maintain temperature and humidity within ranges stated in manufacturer's instructions.

C. Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.

D. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

3.3 EXTERIOR STORAGE

A. Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.

B. For products subject to discoloration or deterioration from exposure to the elements, cover with impervious sheet material. Provide ventilation to avoid condensation.

C. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.

D. Provide surface drainage to prevent erosion and ponding of water.

E. Prevent mixing of refuse or chemically injurious materials or liquids.

3.4 MAINTENANCE OF STORAGE

A. Periodically inspect stored products on a scheduled basis.
B. Verify that storage facilities comply with manufacturer's product storage requirements.

C. Verify that manufacturer required environmental conditions are maintained continually.

D. Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of contract documents.

3.5 MAINTENANCE OF EQUIPMENT STORAGE

A. For mechanical and electrical equipment in long-term storage, provide manufacturer's service instructions to accompany each item, with notice of enclosed instructions shown on exterior of package.

B. Service equipment on a regularly scheduled basis, maintaining a log of services; submit as a record document.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements and limitations for cutting and patching of work.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Work by Owner or by separate contractors.
2. Section 01 62 00 - Product Options.
3. Individual Specifications Sections:
   a. Cutting and patching incidental to work of the section.
   b. Advance notification to other Sections of openings required in work of those sections.
   c. Limitations on cutting structural members.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit written request in advance of cutting or alteration which affects
1. Structural integrity of any element of the project.
2. Integrity of weather-exposed or moisture-resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight-exposed elements.
5. Work of Owner or separate contractor.

C. Include in request
1. Identification of project.
2. Location and description of affected work.
3. Necessity for cutting or alteration.
4. Description of proposed work and products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner or separate contractor.
7. Written permission of affected separate contractor.
8. Date and time work will be executed.

1.3 PAYMENT FOR COSTS

A. Costs resulting from ill-timed or defective work, or work not conforming to contract documents, including costs for additional services of Architect or other consultants, shall be borne by the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products: Those required for original installation.

B. For any change in materials, submit request for substitution under provisions of SECTION 01 62 00 - PRODUCT OPTIONS.

PART 3 - EXECUTION

3.1 GENERAL

A. Execute cutting, fitting and patching including excavation and fill, to complete work, and to
   1. Fit the several parts together, to integrate with other work.
   2. Uncover work to install ill-timed work.
   3. Remove and replace defective and non-conforming work.
   4. Remove samples of installed work for testing.
   5. Provide openings in elements of work for penetrations of mechanical and electrical work.

3.2 INSPECTION

A. Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

B. After uncovering, inspect conditions affecting performance of work.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.3 PREPARATION

A. Provide temporary supports to assure structural integrity of surroundings; devices and methods to protect other portions of project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

C. Maintain excavations free of water.

3.4 PERFORMANCE

A. Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

B. Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

D. Restore work with new products in accordance with requirements of contract documents.

E. Fit work tight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. At penetrations of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated packing material, full thickness of the construction element.

G. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

END OF SECTION

SECTION 01 74 13

CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Throughout the construction period, maintain the building and site in a standard of cleanliness as described in this section.

B. Related Requirements: In addition to standards described in this section, comply with requirements for cleaning as described in other pertinent sections of these specifications.

1.2 QUALITY ASSURANCE

A. Conduct a daily inspection, and more often if necessary, to verify that requirements for cleanliness are being met.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:
1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
2. Do not allow accumulation of scrap, debris waste material, and other items not required for construction of the work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the project site.
4. Provide adequate storage for all items awaiting removal from the project site, observing requirements for fire protection and protection of the ecology.

B. Site:
1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service arrangements to meet the requirements of this section.
3. Maintain the site in a neat and orderly condition at all times.

C. Structure:
1. Weekly, and more often if necessary, inspect the structure and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.

a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a hand-held broom.

3. As required preparatory to installation of succeeding materials, clean the structure or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials are installed.

D. "Clean", for the purpose of this subparagraph shall be interpreted as meaning free from foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.

3.2 FINAL CLEANING

A. "Clean", for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provide by skilled cleaners using commercial quality building maintenance equipment and materials.

B. Prior to completion of the work, remove from the project site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in this section.

C. Site:
1. Unless otherwise specifically directed by Architect, broom clean paved areas on the site and public paved areas adjacent to the site.
2. Completely remove resultant debris.

D. Structure:
1. Exterior:
a. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed materials from adjacent surfaces.
c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
d. In event of stubborn stains not removable with water, Architect may require light sandblasting or other cleaning at no additional cost to the Owner.
2. Interior:
a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed material from adjacent surfaces.
c. Remove paint droppings, spots, stains, and dirt from finished surfaces.
3. Glass: Clean inside and outside.
4. Polished Surfaces: To surfaces requiring routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. This does not apply to resilient flooring surfaces. Reference SECTION 09 65 00 - RESILIENT FLOORING for cleaning of resilient flooring.

E. Special floor/base final cleaning requirements:
1. Contractor shall coordinate with the Owner’s housekeeping department for preparing the surfaces for final cleaning by the Contractor and protective coatings installed by the Owner.
2. Protection after final treatment until date of Substantial Completion shall be the responsibility of the Contractor.
3. All repairs or re-application required as a result of damage caused by the Work shall be the responsibility of the Contractor as directed by the Owner.

F. Schedule final cleaning, as approved by the Architect, to enable the Owner to accept a completely clean work.

3.3 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the work, or any portion thereof, prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Architect in accordance with the General Conditions of the Contract for Construction.

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging non-hazardous demolition and construction waste.
2. Recycling non-hazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
1. Division 02 Section "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
2. Division 02 Section "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
3. Division 04 Section "Reinforced Unit Masonry" for disposal requirements for masonry waste.
4. Division 31 Section "Earthwork for Building Construction" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction and Demolition Waste: Debris that includes waste and recyclables generated on-site from construction and from the renovation, demolition, or deconstruction of preexisting structures. It does not include land-clearing debris, such as soil, vegetation, and rocks. Materials that are man-made (e.g., concrete, brick, cement) are considered construction waste even if they were on site.

B. Clean Waste: Nonhazardous materials left over from construction and demolition. Clean waste excludes lead and asbestos.

C. Waste Diversion: A management activity that disposes of waste through methods other than incineration or landfilling. Examples include reuse and recycling.

D. Source Separated: Construction or demolition waste materials that are sorted into separate bins on the project site (aka on-site). This waste strategy often isolates waste materials targeted for reuse, donation, or recycling programs. Typically, sorted materials on-site include metals, wood, ceiling tiles, furniture, and concrete.

E. Commingled Waste: Building waste streams that are combined on the project site and hauled away for sorting into recyclable streams. It is also known as single-stream recycling.

F. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

G. Recycle: Recycling is the collection, reprocessing, marketing, and use of materials that were diverted or recovered from the solid waste stream.

H. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

I. Reuse: Reuse returns materials to active use in the same or a related capacity as their original use, thus extending the lifetime of materials that would otherwise be discarded.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve End-of-Project rates for salvage/recycling of at least 50 percent by weight of total non-hazardous solid waste generated by the Work from a minimum of 4 waste streams. At project completion, update construction waste management plan with final diversion rate. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

   a. Asphalt paving.
   b. Concrete.
   c. Concrete reinforcing steel.
   d. Brick.
   e. Concrete masonry units.
   f. Wood studs.
   g. Wood joists.
   h. Plywood and oriented strand board.
   i. Wood paneling.
   j. Wood trim.
   k. Structural and miscellaneous steel.
   l. Rough hardware.
   m. Roofing.
   n. Insulation.
   o. Doors and frames.
   p. Door hardware.
   q. Windows.
   r. Glazing.
   s. Metal studs.

t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within **30** days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. LEED Submittal: LEED letter template for Construction Waste Management, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

H. Qualification Data: For waste management coordinator and refrigerant recovery technician.

I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator. Waste management coordinator may also serve as LEED coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated quantities of waste generated by the work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Site Diagram: Provide a site diagram illustrating at minimum:

1. LEED Boundary
2. Staging Area
3. Dumpster Location

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale are not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area as designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: Contractor shall be responsible for finding available recycling receivers and processors. Refer to www.nmrecycle.org for list of local recycling receivers and processors.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue as directed by Owner.

D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

E. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum size as directed by asphalt-recycling facility.

1. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
1. Crush concrete and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to size as appropriate for mineral mulch.

a. Crush masonry and screen to comply with requirements in Division 31 Section "Earthwork for Building Construction" for use as general fill or as soil for fill or subbase.

2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.

2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

K. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

a. Comply with requirements in Division 32 Section "Plants." for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

a. Comply with requirements in Division 32 Section "Plants." for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for project closeout, including but not limited to:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operating and maintenance data submittal, including training sessions for equipment and systems.
   4. Submittal of warranties.
   5. Submittal of spare parts and maintenance materials.

B. Related Requirements:
   1. Section 01 11 00 - Summary of Work: record drawings.
   2. Section 01 33 23 - Shop Drawings, Product Data and Samples.
   3. Section 01 74 13 - Progress Cleaning: final cleaning.
   4. Section 08 71 00 - Door Hardware: keys and keying schedule.

1.2 SUBSTANTIAL COMPLETION

A. General: Substantial Completion is defined in Paragraph 9.8.1 of the General Conditions.

B. Preliminary Procedures: Before requesting inspection for certification of substantial completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100% completion for the portion of the work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      a. If 100% completion cannot be shown, include a list of incomplete items, the value of incomplete construction and reasons the work is not complete.
   2. Advise Owner of pending insurance change-over requirements.
   3. Submit specific warranties, maintenance agreements, final certifications and similar documents.
   4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
   5. Submit record drawings, maintenance manuals and similar final record information.
   6. Deliver tools, spare parts, extra stock and similar items.
   7. Make final change-over of permanent locks and transmit keys and keying schedule to the Owner. Advise the Owner's personnel of change-over in security provisions.
   8. Complete start-up testing of systems, and training sessions for Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups and similar elements.
   9. Complete final clean-up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfulfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   1. Architect will repeat the inspection when requested and assured that the work has been substantially completed.

D. Results of the completed inspection will form the basis of requirements for final acceptance.

1.3 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, submit the following. List exceptions in the request.
   1. Final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   2. Updated final statement, accounting for final additional changes to the contract sum.
   3. Certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
   4. Consent of surety to final payment.
   5. Final Liquidated Damages settlement statement.
   6. Evidence of final, continuing insurance coverage complying with insurance requirements.
   7. Evidence of Compliance with Requirements of Governing Authorities
      a. Certificate of Occupancy.
      b. Certificates of Inspection required for mechanical and electrical systems.
   8. Operation and Maintenance Data: Under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.
   9. Warranties and Bonds: Under provisions of SECTION 01 78 30 - WARRANTIES AND BONDS.
   10. Project Record Documents: Under provisions of SECTION 01 78 39 - PROJECT RECORD DOCUMENTS.
   11. Spare Parts and Maintenance Materials: Under provisions of SECTION 01 78 40 - SPARE PARTS, OVERAGES AND MAINTENANCE MATERIALS.
   12. Keys and Keying Schedule: Under provisions of SECTION 08 71 00 - DOOR HARDWARE.
   13. Evidence of Payment and Release of Liens: In accordance with General Conditions of the Contract for Construction.
   14. Evidence of Payment of Debts and Claims: In accordance with General Conditions of the Contract for Construction.
   15. Certificate of Project Compliance: Required under provisions of NMHED for higher education facilities
   16. Certification of Asbestos and Lead Free Project: The Contractor shall submit to the Architect a letter addressed to the Owner certifying that no materials used in the construction of this project contain lead nor asbestos materials in excess of amounts allowed by local/state standards, laws, codes, rules and regulations, Federal Environmental Protection Agency (EPA) standards and the Federal Occupational Safety and Health Administration (OSHA) standards, whichever are most restrictive. Certification shall further state that should lead or asbestos fibers be found in this project in concentrations greater than the allowed amounts, that the Contractor shall be responsible for determining which materials contain the lead or asbestos fibers and shall take corrective action to remove those materials from the project at no additional cost to the Owner. Final payment shall not be made until this letter of certification has been received.

B. Re-inspection Procedures: Architect will re-inspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been complete, except items whose completion has been delayed because of circumstances acceptable to the Architect.
   1. Upon completion of re-inspection, the Architect will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   2. If necessary, re-inspection will be repeated.

C. Re-inspection Fees: Should status of completion of work require re-inspection by Architect due to failure of work to comply with Contractor's claims on initial inspection, Owner will deduct the amount of Architect and appropriate consultants compensation for re-inspection services from final payment to Contractor. The reimbursement transaction shall be executed by change order

to the contract.

1.4 CLOSEOUT PROCEDURES

A. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in three individual heavy-duty 3-1/2", three-ring vinyl-covered binders, with identification on front and spine of each binder. Include the following types of information:
   1. Emergency instructions.
   2. Spare parts list.
   3. Copies of warranties.
   4. Wiring diagrams.
   5. Recommended "turn around" cycles.
   6. Inspection procedures.
   7. Shop drawings.
   8. Fixture lamping schedule.

B. Shop Drawings: Keep and maintain a full set of submittals throughout the construction phase to be submitted to the Architect with other close-out documents for delivery to the Owner for his permanent record. Set of submittals shall be delivered to the Architect in cardboard file boxes with string and button type closures. Organize submittals by CSI divisions, utilizing neatly labeled pressboard dividers to separate the sections. Neatly label short end of box with project name, contents and duration of construction.

C. Operating and Maintenance Training Sessions: Prepare a written agenda of items to be covered at each training session. Attendance by Owner's operating and maintenance personnel is mandatory. Notify Owner not less than 48 hours prior to scheduled training sessions.
   1. Arrange for each installer of equipment and systems that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
      a. Maintenance manuals.
      b. Record documents.
      c. Spare parts and materials.
      d. Tools.
      e. Lubricants.
      f. Fuels.
      g. Identification systems.
      h. Control sequences.
      i. Hazards.
      j. Cleaning.
      k. Warranties and bonds.
      l. Maintenance agreements and similar continuing commitments.
   2. Training sessions shall consist of not less than five days of not less than four hours each day. A copy of maintenance manuals for equipment or system being demonstrated shall be on hand during training session. As part of instruction for operating equipment, demonstrate the following procedures:
      a. Start-up.
      b. Shutdown.
      c. Emergency operations.
      d. Noise and vibration adjustments.
      e. Safety procedures.
      f. Economy and efficiency adjustments.
      g. Effective energy utilization.
   3. Training sessions shall be conducted for:
      a. Irrigation system.
      b. Food service equipment.
      c. Elevator.
      d. HVAC systems.

e. Energy management controls.
f. Public address system.
g. Fire alarm and smoke detection systems.

1.5 DEMONSTRATION AND TRAINING DVDs

A. General: Engage a qualified commercial photographer to record demonstration and training DVDs. Record each training session separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids.
1. Digital Format: Provide high-quality DVD color recording.
2. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
3. Narration: Describe scenes by audio narration by microphone while being recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
4. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from recording opposite the corresponding narration segment.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

C. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.
2. Documentation: Review the following items in detail:
a. Emergency manuals.
b. Operations manuals.
c. Maintenance manuals.
d. Project record documents.
e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions
i. Operating procedures for emergencies.

j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Format and content of manuals.
   2. Instruction of Owner's personnel.
   3. Schedule of submittals.

B. Related Requirements:
   1. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
   2. Section 01 45 00 - Quality Control: Manufacturer's instructions.
   3. Section 01 77 00 - Closeout Procedures.
   4. Section 01 78 30 - Warranties and Bonds.
   5. Section 01 78 39 - Project Record Documents.
   6. Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.2 QUALITY ASSURANCE

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.3 FORMAT

A. Prepare data in the form of an instructional manual.

B. Binders: Bind in three individual heavy-duty 8-1/2" x 11" black, three-ring binders with hardback, cleanable, plastic covers; 3" maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; list title of project identify subject matter of contents.

D. Arrange content by systems, under section numbers and sequence of table of contents of this project manual.

E. Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer's printed data, or typewritten data on 20-pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.4 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of project; names, addresses, and telephone numbers of Architect/Engineer and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System: List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use project record documents as maintenance drawings.

E. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in SECTION 01 45 00 - QUALITY CONTROL.

F. Warranties and Bonds: Bind in copy of each.

1.5 MANUAL FOR MATERIALS AND FINISHES

A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture-protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional Requirements: As specified in individual specifications sections.

E. Provide a listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.6 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.

C. Include as-installed color coded wiring diagrams.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide as-installed control diagrams by controls manufacturer.

K. Provide Contractor's coordination drawings, with as-installed color coded piping diagrams.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Additional Requirements: As specified in individual specifications sections.

O. Provide a listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.7 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, perform instructions for other seasons within six months.

B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

C. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

1.8 SUBMITTALS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.

C. Submit one copy of completed volumes in final form 15 days prior to final inspection. Copy will be returned after final inspection, with Architect/Engineer comments. Revise content of documents as required prior to final submittal.

D. Submit two copies of revised volumes of data in final form within 10 days after final inspection.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 30

WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparation and submittal of warranties and bonds.
   2. Schedule of submittals.

B. Related Requirements:
   1. General Conditions of the Contract for Construction: Performance Bond and Labor and Material Payment Bonds, Warranty, and Correction of Work.
   2. Section 01 77 00 - Closeout Procedures.
   3. Section 01 78 23 - Operation and Maintenance Data.
   4. Section 01 78 39 - Project Record Documents.
   5. Individual Specifications Sections: Warranties and bonds required for specific products or work.

1.2 FORM OF SUBMITTALS

A. Bind in three individual heavy-duty 8-1/2" x 11" black, three-ring binders, with hardback, cleanable, plastic covers.

B. Label cover of each binder with typed or printed title WARRANTIES AND BONDS, with title of project; name, address and telephone number of Contractor; and name of responsible principal.

C. Table of Contents: Neatly typed, in the sequence of the table of contents of the project manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

D. Separate each warranty or bond with index tab sheets keyed to the table of contents listing. Provide full information, using separate typed sheets as necessary. List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.3 PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the date of substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

1.4 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

B. Make other submittals within 10 days after date of substantial completion, prior to final application for payment.

C. For items of work when acceptance is delayed beyond date of substantial completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Maintenance and submittal of record documents and samples.

B. Related Requirements:
1. General Conditions of the Contract for Construction: Documents at the site.
2. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
3. Section 01 77 00 - Closeout Procedures.
4. Section 01 78 23 - Operation and Maintenance Data.
5. Individual Specifications Sections: Manufacturer's certificates and certificates of inspection.

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. In addition to requirements in General Conditions, maintain at the site for Owner one record copy of:
1. Contract drawings.
2. Specifications.
3. Addenda.
4. Change orders and other modifications to the contract.
5. Reviewed shop drawings, product data, and samples.
6. Field test records.
7. Inspection certificates.
8. Manufacturer's certificates.

B. Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage for record documents and samples.

C. Label and file record documents and samples in accordance with section number listings in table of contents of this project manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

D. Maintain record documents in a clean, dry and legible condition. Do not use record documents for construction purposes.

E. Keep record documents and samples available for inspection by Architect.

1.3 RECORDING

A. Record information on a set of opaque drawings, and in a copy of a project manual. All changes made in these drawings in connection with the final construction and installation shall be neatly made in red ink on the prints.

B. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.

C. Contractor shall include with the record documents, all changes and modifications made by addenda, change orders, supplementary instructions, or other forms of documentation, written or verbal, which alter the documents.

D. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

E. Contract drawings and shop drawings: Legibly mark each item on the drawings to record actual construction, including:
   1. Measured depths of elements of foundation in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
   4. Field changes of dimension and detail.
   5. Changes made by addenda and modifications.
   6. Details not on original contract drawings.
   7. References to related shop drawings and modifications.

F. Specifications: Legibly mark each item in the specifications to record actual construction, including:
   1. Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.
   2. Changes made by addenda and modifications.

G. Other Documents: Maintain manufacturer's certifications, inspection certifications, field test records, and other documents required by individual specifications sections.

H. Maintain these documents to reflect the current conditions of the work. Changes shall be reviewed on a monthly basis with the Architect's representative. The Contractor's updating of the "installed condition drawings" shall be a prerequisite to the monthly review of the Contractor's payment request by the Architect's representative.

1.4 SUBMITTALS

A. At contract closeout, deliver record documents and samples under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Transmit with cover letter in duplicate, listing:
   1. Date.
   2. Project title and number.
   3. Contractor's name, address, and telephone number.
   4. Number and title of each record document.
   5. Signature of Contractor or authorized representative.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 40

SPARE PARTS, OVERAGES AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Includes:
1. Products required.
2. Storage and delivery of products.

B. Related Requirements:
1. Section 01 66 00 - Product Storage and Handling Requirements.
2. Section 01 77 00 - Closeout Procedures.
3. Section 01 78 23 - Operation and Maintenance Data.
4. Individual Specifications Sections: Specific spare parts and materials required.

1.2 PRODUCTS REQUIRED

A. Provide quantities of products, spare parts, maintenance tools, and maintenance materials specified in individual sections to be provided to Owner, in addition to that required for completion of work.

B. Products: Identical to those installed in the work. Include quantities in original purchase from manufacturer to avoid variations in manufacture.

1.3 STORAGE, MAINTENANCE

A. Store products with products to be installed in the work, under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. When adequate, secure storage facilities are available at site, capable of maintaining conditions required for storage and not required for contract work or storage, or for Owner's needs, spare products may be stored in available space.

C. Maintain spare products in original containers with labels intact and legible, until delivery to Owner.

1.4 DELIVERY

A. Coordinate with Owner: Deliver and unload spare products to Owner at project site and obtain receipt prior to final payment.

B. For portions of project accepted and occupied by Owner prior to substantial completion, deliver a proportional part of spare products to Owner; obtain receipt.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 8113

SUSTAINABLE DESIGN REQUIREMENTS - LEED v4 NEW CONSTRUCTION AND MAJOR RENOVATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
B. US Green Building Council, LEED Reference Guide for Building Design and Construction v4 and v4.1, April 2021, with addenda.
C. Divisions 01 through 32 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.
D. Supplement 8113-01: LEED v4 Checklist.

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Silver certification based on the US Green Building Council, LEED Reference Guide for Building Design and Construction v4 and v4.1, April 2021, with addenda.
    1. LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
    2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification level depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
    3. A copy of the LEED Project checklist is attached at the end of this Section for information only.
    4. Contractor prerequisite requirements:
        a. Sustainable Sites: Construction Activity Pollution Prevention
        b. Materials and Resources: Construction and Demolition Waste Planning
    5. Contractor point requirements:
        a. A minimum of (3) Point(s) from the following credits:
            i. Materials and Resources: Building Product Disclosure and Optimization – Environmental Product Declarations (1 Point)
            ii. Materials and Resources: Building Product Disclosure and Optimization – Sourcing Raw Materials (1 Point)
            iii. Materials and Resources: Building Product Disclosure and Optimization – Material Ingredients (1 Point)
        b. Materials and Resources: Construction and Demolition Waste Management (1 Point)
        c. Indoor Environmental Quality: Low-Emitting Materials (3 Points)
        d. Indoor Environmental Quality: Construction Indoor Air Quality Management (1 Point)

6. The above requirement does not prohibit the Contractor from achieving additional construction phase credits to support the required LEED certification level.

1.3 DEFINITIONS

A. GBCI: Green Business Certification Institute. Credentialing body that administers LEED project certifications.
B. USGBC: United States Green Building Council.
C. LEED: Leadership in Energy and Environmental Design.
D. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that the manufacturer and vendor are certified for chain of custody by an FSC-accredited certification body.
E. Product: a “product” or a “permanently installed building product” is defined by its function in the project. A product includes the physical components and services needed to serve the intended function.
    1. An item that arrives on the project site either as a finished element ready for installation or as a component to another item assembled on-site.
    2. The product unit is defined by the functional requirement for use in the project; this includes the physical components and services needed to serve the intended function of the permanently installed building product.
    3. Similar products within a specification that have distinct formulations may contribute as separate products.
F. Product and Material Cost (LEED): Includes taxes and expenses to deliver the material to the project site incurred by the Contractor.
    1. Excludes cost for labor and equipment required for installation after the material is delivered to the site.
G. Location Valuation Factor: For a product to qualify for the location valuation factor, it must meet two conditions: all extraction, manufacture, and purchase (including distribution) of the product and its materials must occur within a 100-mile radius of the project site and the product (or portion of an assembled product) must meet at least one sustainable criteria specified in the credit.
    1. Distance shall be calculated as the crow flies, not by actual travel distance. The point of purchase is considered the location of product distribution.
H. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value:
    1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
    2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
I. Bio-based Material: Commercial or industrial products (other than food or feed) that are composed in whole, or in significant part, of biological products, renewable agricultural materials (including plant, animal, and marine materials), or forestry materials. For the purposes of LEED, this excludes leather and other animal hides.
    1. Bio-based materials shall meet the Sustainable Agriculture Network’s Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country.

J. Hazardous Material: Any item or agent (biological, chemical, physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.
K. Raw Material: The basic substance from which products are made, such as concrete, glass, gypsum, masonry, metals, recycled materials (e.g., plastics and metals), oil (petroleum polylactic acid), stone, agrifiber, bamboo, and wood.
L. Extended Producer Responsibility: Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life. Producers recover and recycle the materials for use in new products of the same type. To count toward credit compliance, a program must be widely available. For carpet, extended producer responsibility must be consistent with NSF/ANSI 140–2015. Also known as closed-loop program or product take-back.
M. Manufacturer Inventory: Publicly available inventory of all product ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
N. Cradle to Gate Assessment: Analysis of a product's partial life cycle, from resource extraction (cradle) to the factory gate (before it is transported for distribution and sale). It omits the use and the disposal phases of the product.
O. Health Product Declaration: The end use product has a published, complete Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard.
P. Environmental Product Declaration: A statement that the item meets the environmental requirements of ISO 14025 and EN 15804, or ISO 21930.
Q. Life-cycle Assessment: An evaluation of the environmental effects of a product from cradle to grave, as defined by ISO 14044 or ISO 14071.
R. Reuse: The reemployment of materials in the same or a related capacity as their original application, thus extending the lifetime of materials that would otherwise be discarded. Reuse includes the recovery and reemployment of materials recovered from existing building or construction sites. Also known as salvage.
S. Building Interior (LEED): Everything within the waterproofing membrane.
T. Building Exterior (LEED): Everything outside of and including the waterproofing membrane.
U. VOC: Volatile Organic Compound.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect and the GBCI regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the GBCI has made its determination on the project's LEED certification application. Document responses as informational submittals.
B. LEED Coordination Meetings
    1. Commissioning Kickoff Meeting: Review OPR and all Project commissioning coordination activities. Reference Specification Division 01.
    2. Preconstruction Meeting: Conduct conference at jobsite or other agreed-upon location. Review LEED requirements and action plans for complying with requirements.
    3. Construction Meetings: Review construction status reports and time sensitive construction activities related to LEED credits at least monthly, or as frequently as needed.

1.5 LEED ACTION SUBMITTALS

A. All materials and products between divisions 3-32 that contain a reference or relation to 01 81 13 within their PART 1 General apply to this section.
B. Submit additional LEED submittals required by other Specification Sections, Division 3-10, Division 21-26: piping, pipe insulation, ducts, duct insulation, and conduit, 31 and 32.

C. LEED submittals may be combined with other submittals if the submitted item is identical to that submitted to comply with other requirements. If available, submit product data at the end of each submittal to verify compliance with LEED requirements.
D. Project Materials Cost Data:
    1. Provide materials cost data for products to be installed under each specification section.
E. LEED Action Plans: Provide preliminary submittals within **30** days of date established for the Notice to Proceed and reports according to the following**:**
    1. SS Prerequisite: Construction Activity Pollution Prevention Plan. Project-specific Erosion and Sedimentation Control Plan.
    2. MR Prerequisite and Credit: Construction and Demolition Waste Management Planning. Project-specific Construction Waste Management Plan.
    3. EQ Credit: Construction Indoor Air Quality Management. Project-specific Construction Indoor Air Quality Management Plan.
F. LEED Credit Requirements:
    1. EA Credit Advanced Energy Metering: Provide product data for interval recording meters.
    2. WE Credit Indoor Water Use Reduction: Provide product data for all newly installed toilets, urinals, private lavatory faucets, and showerheads that are eligible as being WaterSense labeled.
    3. SS Credit Heat Island Reduction:
        a. Use roofing materials that meet the following conditions:
            i. For Low-sloped roofs
                A. Slopes < 2:12 pitch
                B. Initial SRI value of at least 82
                C. 3-year aged SRI of at least 64
            ii. For Steep-sloped roofs
                A. Slopes > 2:12 pitch
                B. Initial SRI value of at least 39
                C. 3-year aged SRI of at least 32
        b. If three-year aged value information is not available, use materials that meet the initial SRI value.
    4. MR Prerequisite and Credit Construction and Demolition Waste Management: Comply with Division 01 Section "Construction and Demolition Waste Management."
    5. MR Credit Environmental Product Declaration: Provide a list of products that contribute to the following material categories:
        a. Environmental Product Declaration (EPD)
            i. Use at least 20 different permanently installed products sourced from at least five different manufacturers that meet one of the following disclosure criteria. The project must achieve a minimum whole product value of 20 to comply with credit requirements.
                A. Life-cycle assessment and environmental product declarations
                1) Products with a publicly available, critically reviewed life-cycle assessment.
                2) Product-specific Type III EPD
                3) Industry-wide Type III EPD
                B. Product-specific Type III Environmental Product Declaration (EPD) with third-party certification – valued as 1.5 products.
        b. Embodied Carbon/LCA Optimization
            i. Use products that have a compliant embodied carbon optimization report or action plan separate from the LCA or EPD. Use at least 5 permanently installed products sourced from at least three different manufacturers.

6. MR Credit Building Product Disclosure and Optimization, Sourcing of Raw Materials:
    a. Responsible Sourcing of Raw Materials: Use products that meet at least one of the responsible extraction criteria below for at least 15%, by cost, of the total value of permanently installed building products in the project for 1-point and 30% for 2-points:
        i. Extended Producer Responsibility (EPR) program participation.
        ii. Bio-Based Materials
        iii. Forest Stewardship Council Certification (wood products)
        iv. Material Reuse
        v. Recycled Content
        vi. Regional Content
7. MR Credit Optimization of Material Ingredients:
    a. Material Ingredient Reporting: Use at least 20 different permanently installed products from at least five different manufacturers to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm).
    b. Material Ingredient Optimization: Use products that have a compliant material ingredient report or action plan. Use at least 5 permanently installed products sourced from at least three different manufacturers. Products are valued according to the table below.
        i. Optimization Action Plan
        ii. Cradle to Cradle Certified
        iii. Declare
        iv. Health Product Declaration
        v. Living Product Challenge
        vi. Manufacturer Inventory
8. EQ Credit Low Emitting Materials
    a. Interior Wet-Applied Products: 75% of products wet-applied within the building envelope must meet the applicable emissions evaluation and 100% of the same products must meet the applicable VOC Content limits, and provide volume or surface area for the following categories:
        i. Paints and Coatings
        ii. Adhesives and Sealants
    b. Interior Installed Products: Products installed within the building envelope must applicable emissions evaluations and provide costs or surface area for the following categories:
        i. Flooring, 90% of all flooring materials
        ii. Ceilings, 90% of all ceiling materials
        iii. Insulation, 75% of all insulation materials
    c. Composite Wood Products: Provide cost or surface area for each product. At least 75% of all composite wood must meet one of the following:
        i. Formaldehyde emissions evaluation
        ii. <salvaged and reused materials criteria.>
9. EQ Credit Construction Indoor Air Quality Management Plan:
    a. Construction indoor-air-quality management plan
    b. Product data for temporary filtration media
    c. Product data for filtration media used during occupancy
    d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
10. EQ Credit Indoor Air Quality Assessment:

a. Signed statement describing the building air flush-out procedures including:
    i. Dates and times of flush-out commencement and completion
    ii. Confirmation that, during period of flush-out, relative humidity did not exceed 60% and internal temperature was at least 60 degrees F and no higher than 80 degrees F
    iii. Statement that filtration media was replaced after flush-out
        A. Product data for filtration media used during flush-out and during occupancy.
b. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.

1.6 LEED INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.
B. Project Materials Cost Data:
    1. Provide a total project cost statement, indicating the actual materials cost. This is the cost of all materials being used on the project site, excluding labor but including delivery & taxes.
C. LEED Action Plans: Indicate how the following requirements will be met:
    1. SS Prerequisite: Construction Activity Pollution Prevention.
        a. Implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the erosion and sedimentation requirements of the 2012 U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) or local equivalent, whichever is more stringent. Projects must apply the CGP regardless of size. The plan must describe the measures implemented.
    2. MR Credit: Construction and Demolition Waste Management Planning, in compliance with Division 01 Section "Construction and Demolition Waste Management."
    3. EQ Credit: Construction Indoor Air Quality Management Plan.
        a. Implement an indoor air quality management plan for the construction and preoccupancy phases of the building. The plan must address all the following:
            i. During construction, meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.
            ii. Protect absorptive materials stored on-site and installed from moisture damage.
            iii. Do not operate permanently installed air-handling equipment during construction unless filtration media with a minimum efficiency reporting value (MERV) of 8, as determined by ASHRAE 52.2–2007, with errata (or equivalent filtration media class of F5 or higher, as defined by CEN Standard EN 779–2002, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance), are installed at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media. Immediately before occupancy, replace all filtration media with the final design filtration media, installed in accordance with the manufacturer’s recommendations.
            iv. Prohibit the use of tobacco products inside the building and within 25 feet (7.5 meters) of the building entrance during construction.

D. MR Credit Building Product Disclosure and Optimization, Environmental Product Declaration: Provide the following product data and declarations as available for each product:
   1. Environmental Product Declaration (EPD)
      a. Life-Cycle Assessment - Products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
      b. Industry-wide Type III EPD - Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. Must conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
      c. Internally reviewed Product-specific Type III EPD - Products with an internally critically reviewed LCA in accordance with ISO 14071. Products with product-specific internal EPDs which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
      d. Externally reviewed Product Specific type III EPDs - must conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
         i. Products with third-party certification (Type III), including external verification of the LCA and external critical review of the EPD.
   2. Embodied Carbon/LCA Optimization:
      a. Provide third party certification demonstrating impact reduction below industry average in at least three of the following categories
         i. Global warming potential (greenhouse gases), in CO_2e;
         ii. Depletion of the stratospheric ozone layer, in kg CFC-11e;
         iii. Acidification of land and water sources, in moles H+ or kg SO_2e;
         iv. Eutrophication, in kg nitrogen equivalent or kg phosphate equivalent;
         v. Formation of tropospheric ozone, in kg nox, kg O_3 eq, or kg ethene; and
         vi. Depletion of nonrenewable energy resources, in MJ using CML / depletion of fossil fuels in TRACI.

E. MR Credit Sourcing of Raw Materials:
   1. For credit achievement calculation, the base contributing cost of individual products compliant with multiple responsible extraction criteria is not permitted to exceed 100% its total actual cost (before regional multipliers) and double counting of single product components compliant with multiple responsible extraction criteria is not permitted and in no case is a product permitted to contribute more than 200% of its total actual cost.
   2. Provide product data and costs for the following responsible extraction criteria as applicable:
      a. Extended Producer Responsibility (EPR): Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility. Products meeting extended producer responsibility criteria are valued at 50% of their cost for the purposes of credit achievement calculation.
         i. EPR claims must be made in accordance with ISO 14021.
         ii. The manufacturer and/or programs have provided documentation showing participation in any of the following EPR platforms to contribute to LEED:
            A. Manufacturer Based Programs
            B. Third Party program
      b. Bio-based materials: valued at 100% of their cost for the purposes of credit achievement.
         i. Bio-based materials. Bio-based products and materials other than wood must be tested using ASTM Test Method D6866 or equivalent method ISO 16620-2, or be certified to the USDA BioPreferred Voluntary

Labeling Initiative that includes verification via ASTM 6866 testing. Exclude hide products, such as leather and other animal skin material.

A. Bio-based products that meet the criteria above: value at 50% of cost multiplied by the biobased content of the product for the purposes of credit achievement calculation.
B. Bio-based products that meet the Sustainable Agriculture Network's Sustainable Agriculture Standard in addition to the testing requirements above: value at 100% of cost multiplied by the biobased content of the product for the purposes of credit achievement calculation.

c. Wood Products: Products certified by the Forest Stewardship Council are valued at 100% of their cost for the purposes of credit achievement.
   i. Certificates for Extraction Reporting: Chain-of-custody certificates indicating that interior architectural woodwork complies with forest certification requirements. Include documentation that manufacturer maintains a valid certificate for chain of custody by an FSC-accredited certification body. Upon final sale the invoice for all wood products sold to the project contractors or subcontractors (who do not modify the product off-site) are required to be submitted.
   ii. For all wood products designated in this specification as "FSC certified," provide evidence of compliance with FSC standards as follows:
      A. Demonstrate that products are FSC certified by providing vendor invoices. Invoices will contain the vendor's Chain-of-Custody (COC) number and identify each FSC certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
      B. Wood products without submittal of acceptable documentation will still be included in calculations but will not contribute to the certified wood weighting.
d. Material Reuse: Products meeting materials re-use criteria are valued at 200% of their cost for the purposes of credit achievement.
   i. Determine the cost of each material. The cost of reused or reclaimed materials is either the actual cost paid or the replacement value, whichever is higher. Core materials must not contain toxic substances and may be eligible to include:
      A. salvaged brick
      B. structural timber
      C. railroad ties
      D. stone
      E. pavers
e. Recycled Content: Products meeting recycled content criteria are valued at 100% of their cost for the purposes of credit achievement.
   i. Documentation is required indicating percentages by weight of post-consumer and pre-consumer recycled content. Include statement indicating cost and qualifying percentage for each product having recycled content.
f. Regional Content: For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost.
   i. Documentation is required indicating distances including the distribution, purchase locations, and all points of manufacture. Include statement

indicating cost and qualifying percentage for each product having regional content.

F. MR Credit Building Product Disclosure and Optimization, Material Ingredients: Follow one or both of the following options and provide product data and declarations as available for each product:
    1. Material Ingredient Reporting
        a. Provide documentation of the product manufacturer's participation in any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm)
            i. Manufacturer Inventory
            ii. Health Product Declaration
            iii. Cradle to Cradle Certification
            iv. Other USGBC approved program
    2. Material Ingredient Optimization
        a. Provide product data for the following material ingredient optimization criteria as applicable:
            i. Optimization Action Plan
            ii. Advanced Inventory & Assessment:
                A. Cradle to Cradle Certified: certified or Material Health Certificate at Bronze level or higher.
                B. Declare labels designated as Red List Free or LBC Red List Free.
                C. Health Product Declaration that meet optimization and verification criteria.
                D. Living Product Challenge certified products that include a Red List Free or LBC Red List Free Declare label.
                E. Manufacturer Inventory that meet optimization and verification criteria.
            iii. Material Ingredient Optimization.
        b. Cradle to Cradle Certified or Material Health Certificate at Silver level or higher.

G. MR Credit: Construction and Demolition Waste Management Planning, provide waste tickets in compliance with Division 01 Section "Construction and Demolition Waste Management."

H. EQ Credit Low Emitting Materials: Provide a list of products that contribute to the following criteria:
    1. CDPH Emissions Evaluation: Demonstrate General Emissions Evaluation compliance by one of the following standards:
        a. Product has been tested according to California Department of Public Health (CDPH) Standard Method v1.2–2017 and complies with the VOC Content limits in Table 4-1 of the method. Additionally, the range of total VOCs after 14 days (336 hours) was measured as specified in the CDPH Standard Method v1.2 and is reported (TVOC ranges: 0.5 mg/m3 or less, between 0.5 and 5 mg/m3, or 5 mg/m3 or more).
        b. Laboratories that conduct the tests must be accredited under ISO/IEC 17025 for the test methods they use. Products used in any setting other than schools and classrooms must be modeled to private office scenario.
        c. The statement of product compliance must include the exposure scenario(s) used, the range of total VOCs, and must follow the product declaration guidelines in CDPH Standard Method v1.2-2017, Section 8. Manufacturer statements must also include a summary report from the laboratory that is less than three years old and the amount of wet-applied product applied in mass per surface area (if applicable). Organizations that certify manufacturers' claims must be accredited under ISO/IEC 17065.
        d. Inherently non-emitting sources

e. Product is an inherently non-emitting source of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood) and has no binders, surface coatings, or sealants that include organic chemicals.
f. CDPH Emissions Evaluation must apply to the following categories:
   i. Paints and Coatings, a minimum of 75% by volume
   ii. Adhesives and Sealants, a minimum of 75% by volume
   iii. Flooring, a minimum of 90% by cost
   iv. Walls
   v. Ceilings, a minimum of 90% by cost
   vi. Insulation, a minimum of 75% by cost

2. Composite Wood Products: At least 75% of all composite wood products, by cost, must be documented to have low formaldehyde emissions that meet one of the following:
   a. Certified as ultra-low-emitting formaldehyde (ULEF) product under EPA Toxic Substances Control Act, Formaldehyde Emission Standards for Composite Wood Products (TSCA, Title VI) (EPA TSCA Title VI) or California Air Resources Board (CARB) Airborne Toxic Control Measure (ATCM).
   b. Certified as no added formaldehyde resins (NAF) product under EPA TSCA Title VI or CARB ATCM.
   c. Wood structural panel manufactured according to PS 1-09 or PS 2-10 (or one of the standards considered by CARB to be equivalent to PS 1 or PS 2) and labeled bond classification Exposure 1 or Exterior.
   d. Structural wood product manufactured according to ASTM D 5456 (for structural composite lumber), ANSI A190.1 (for glued laminated timber), ASTM D 5055 (for I-joists), ANSI PRG 320 (for cross-laminated timber), or PS 20-15 (for finger-jointed lumber).
3. VOC content:
   a. Paints and Coatings: All Paints and Coatings wet-applied on site must meet the applicable VOC Content limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.
   b. Adhesives and Sealants: All Adhesives and Sealants wet-applied on site must meet the applicable VOC content requirements of SCAQMD Rule 1168, October 6, 2017, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168.
   c. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

I. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
   1. Construction and Demolition Waste Management diversion rates.
   2. LEED Product Documentation required to demonstrate project compliance with the LEED MR - Materials and Resources credit requirements.
   3. LEED Product Documentation required to demonstrate project compliance with the LEED EQ – Low Emitting Materials credit requirements.

1.7 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.
B. All wood products designated as “FSC certified” in this specification shall be certified according to the rules of the Forest Stewardship Council (www.fscus.org).

C. To review a list of North American Certification Bodies that are accredited by the FSC to certify forest products, go to (https://us.fsc.org/en-us/certification/certifying-bodies-in-the-us)

PART 2 – PARTS

2.1 MATERIALS GENERAL

A. All materials and products between divisions 3-32 that contain a reference or relation to 01 81 13 within their PART 1 General apply to this section. Supplemental tables will determine applicable LEED categories and appropriate submittal actions.

PART 3 – EXECUTION

3.1 REFRIGERANT AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENT REMOVAL

A. Prerequisite EA Fundamental Refrigerant Management: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in Division 23 Sections.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. MR Credit: Construction and Demolition Waste Management Planning, provide waste tickets in compliance with Division 01 Section "Construction and Demolition Waste Management."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT PLAN

A. Meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.
    1. Coordinate first subparagraph below with Division 01 Section "Temporary Facilities and Controls." Identify air handlers and associated return-air inlets authorized by Owner for use during construction period.
        a. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2-2007 at each return-air inlet for the air-handling system used during construction.
        b. Replace all air filters immediately prior to occupancy.
    2. Protect absorptive materials stored on-site and installed from moisture damage
    3. Prohibit the use of tobacco products inside the building and within 25 feet of the building entrance during construction.

3.4 INDOOR AIR QUALITY ASSESSMENT

A. Option-1 Flush-Out:
    1. After construction ends, prior to occupancy and with all interior finishes (including millwork, doors, paint, carpet, acoustic tiles and moveable furnishings) installed, and major

VOC punch list items completed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and no greater than 80 deg F, and a relative humidity no higher than 60 percent.

2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and no greater than 80 deg F, and a relative humidity no higher than 60 percent. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.
3. Commissioning can occur during the flush-out, provided none of the commissioning procedures introduce contaminants into the space and none of the flush-out procedures circumvent the commissioning process. Complete testing and balancing after the flush-out is complete.
4. If partial construction work occurs during the flush-out, the procedure must be started again from the beginning for that space.
5. If multiple discrete HVAC systems operate independently, the team may flush out portions of the building as work is completed in each area served by the given system.
6. If the permanent HVAC system will be used to perform the flush out procedure, first replace used filters with new MERV 13 media and remove any duct coverings installed as part of the construction indoor air quality management plan.>

B. Option-2 Air-Quality Testing:
1. After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline indoor-air-quality testing using protocols consistent with the methods listed in the USGBC's Reference Guide for Building Design and Construction v4 or v4.1 for all occupied spaces. Use current versions of ASTM standard methods, EPA compendium methods, or ISO methods as indicated. Laboratories that conduct tests for chemical analysis of formaldehyde and volatile organic compounds must be accredited under ISO/IEC 17025 for the test methods that they use.
2. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
    a. Formaldehyde: 27 ppb.
    b. Particulates
        i. PM10 for all building: 50 micrograms/cu. m.
        ii. PM 2.5 for buildings in EPA nonattainment areas: 15 micrograms/cu. m.
    c. Ozone for buildings in EPA nonattainment areas: .075 ppm
    d. Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
    e. Target chemicals listed in CDPH Standard Method v1.1, table 4-1, except formaldehyde: CDPH Standard Method v1.1-2010 Allowable Concentrations, table 4-1
    f. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
3. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
4. Air-sample testing shall be conducted as follows:
    a. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily

start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.

b. Building shall have all interior finishes including millwork, doors, paint, carpet, acoustic tiles and moveable furnishings installed, and major VOC punch list items completed.

c. The building must be thoroughly cleaned, including the ductwork, before testing may begin. Use low-emitting cleaning products to prevent high short-term VOC levels that may affect test results. Use vacuum cleaners with HEPA filtration to capture particulates.

d. Number of sampling locations will vary depending on the size of building and number of ventilation systems but must include all occupied spaces. If sampling is used, all space types must be represented. Use the following methodology to determine how many air testing locations are required:

i. Test at least one location per ventilation system for each occupied space type. There must be a minimum of one test per floor. The locations selected for testing must represent the worst-case zones where the highest concentrations of contaminants of concern are likely to occur.

ii. Test areas no larger than 5,000 sq. ft.

iii. For large open spaces such as school gymnasiums, the number of sampling points shall not be less than one per 50,000 sq. ft.

iv. Project teams may sample identical spaces by testing one in seven; if sampled space fails the test, all seven must be tested.

5. Air samples shall be collected between 3 and 6 feet above the floor.
6. The gravimetric method must be used for testing.
7. Indoor Air Quality Testing Report:

a. Submit narrative describing procedures and how locations were determined.

i. Include dates and results of each test.

ii. Include temperature and humidity levels for dates of each test.

END OF SECTION

A. Supplement 8113-01: LEEDv4 Checklist

VERDACITY

LEEDv4 for BD+C:

New Construction and Major Renovations Project Scorecard

Project Name:	**SENMC Vocational Trades & Technologies**
Project Address:	**1500 E. University Drive, Carlsbad, NM 88220**
Date:	**March 20, 2025**
Target:	**LEED Silver**
Legend:	Critical PR & Credits / Construction Credits

Yes	L	U	No					
0	0	1	0	**INTEGRATIVE PROCESS (IP)**			**1**	**Company**
		1		Credit	Integrative Process		1	Verdacity

Yes	L	U	No					
3	0	0	13	**LOCATION AND TRANSPORTATION (LT)**			**16**	**Company**
1				Credit	Sensitive Land Protection		1	Verdacity
1			1	Credit	High Priority Site		2	Verdacity
			5	Credit	Surrounding Density and Diverse Uses		5	Architect
			5	Credit	Access to Quality Transit		5	Architect
			1	Credit	Bicycle Facilities		1	Architect
			1	Credit	Reduced Parking Footprint		1	Architect
1				Credit	Green Vehicles		1	Architect

Yes	L	U	No					
10	0	0	0	**SUSTAINABLE SITES (SS)**			**10**	**Company**
Y				Prereq	Construction Activity Pollution Prevention		Required	Contractor
1				Credit	Site Assessment		1	Owner
2				Credit	Site Development - Protect or Restore Habitat		2	Architect
1				Credit	Open Space		1	Architect
3				Credit	Rainwater Management		3	Civil Engineer
2				Credit	Heat Island Reduction		2	Architect
1				Credit	Light Pollution Reduction		1	Electrical Engineer

Yes	L	U	No					
2	2	2	5	**WATER EFFICIENCY (WE)**			**11**	**Company**
Y				Prereq	Outdoor Water Use Reduction		Required	Verdacity
Y				Prereq	Indoor Water Use Reduction		Required	Verdacity
Y				Prereq	Building-Level Water Metering		Required	Mechanical Engineer
1			1	Credit	Outdoor Water Use Reduction		2	Architect
	2	2	2	Credit	Indoor Water Use Reduction		6	Architect
			2	Credit	Cooling Tower Water Use		2	Mechanical Engineer
1				Credit	Water Metering		1	Mechanical Engineer

Yes	L	U	No					
7	1	0	25	ENERGY & ATMOSPHERE (EA)			33	Company
Y				Prereq	Fundamental Commissioning and Verification		Required	Cx Agent
Y				Prereq	Minimum Energy Performance		Required	Energy Consultant
Y				Prereq	Building-Level Energy Metering		Required	Electrical Engineer
Y				Prereq	Fundamental Refrigerant Management		Required	Mechanical Engineer
3	1		2	Credit	Enhanced Commissioning		6	Cx Agent
2			16	Credit	Optimize Energy Performance		18	Energy Consultant
1				Credit	Advanced Energy Metering		1	Energy Consultant
			2	Credit	Demand Response		2	Owner
			3	Credit	Renewable Energy Production		3	Energy Consultant
1				Credit	Enhanced Refrigerant Management		1	Mechanical Engineer
			2	Credit	Green Power and Carbon Offsets		2	Owner

Yes	L	U	No					
7	4	0	2	MATERIALS & RESOURCES (MR)			13	Company
Y				Prereq	Storage and Collection of Recyclables		Required	Verdacity
Y				Prereq	Construction and Demolition Waste Management Planning		Required	Verdacity
3			2	Credit	Building Lifecycle Impact Reduction		5	Verdacity
1	1			Credit	Building Product Disclosure and Optimization - Environmental Product D		2	Contractor
1	1			Credit	Building Product Disclosure and Optimization - Sourcing Raw Materials		2	Contractor
1	1			Credit	Building Product Disclosure and Optimization - Material Ingredients		2	Contractor
1	1			Credit	Construction and Demolition Waste Management		2	Contractor

Yes	L	U	No					
8	1	1	6	INDOOR ENVIRONMENTAL QUALITY (EQ)			16	Company
Y				Prereq	Minimum Indoor Air Quality Performance		Required	Mechanical Engineer
Y				Prereq	Environmental Tobacco Smoke (ETS) Control		Required	Owner
2				Credit	Enhanced Indoor Air Quality Strategies		2	Mechanical Engineer
3				Credit	Low-Emitting Materials		3	Contractor
1				Credit	Construction Indoor Air Quality Management Plan		1	Contractor
	1		1	Credit	Indoor Air Quality Assessment		2	Contractor
1				Credit	Thermal Comfort		1	Mechanical Engineer
1			1	Credit	Interior Lighting		2	Electrical Engineer
		1	2	Credit	Daylight		3	Daylighting Consultant
			1	Credit	Quality Views		1	Daylighting Consultant
			1	Credit	Acoustic Performance		1	Acoustician

Yes	L	U	No					
3	2	0	1	INNOVATION (IN)			6	Company
1				Credit	Innovation: Purchasing Lamps		1	Verdacity
	1			Credit	Innovation: Exemplary Perf: BPDO- Material Ingredients		1	Contractor
	1			Credit	Innovation: Exemplary Perf: BPDO- EPDs		1	Contractor
1				Credit	Pilot: Daylighting in Non-regularly occupied spaces_v4.1		1	Verdacity
			1	Credit	Innovation: Exemplary Perf: Building LCIA		1	Verdacity
1				Credit	LEED® Accredited Professional		1	Verdacity

Yes	L	U	No					
4	0	0	2	REGIONAL PRIORITY (RP)			4	Company
1				Credit	Regional Priority: Sensitive Land Protection (Thr: 1 pt)		1	Verdacity
			1	Credit	Regional Priority: Surrounding Density and Diverse Uses (Thr: 2 pts)		1	Verdacity
1				Credit	Regional Priority: Outdoor Water Use Reduction (Thr: 1 pt)		1	Verdacity
1				Credit	Regional Priority: Optimize Energy Performance (Thr: 5 pts)		1	Verdacity
			1	Credit	Regional Priority: Renewable Energy Production (Thr: 1 pt)		1	Verdacity
1				Credit	Regional Priority: Thermal Comfort (Thr: 1 pt)		1	Verdacity

Yes	L	U	No	
44	10	4	54	PROJECT TOTALS (Certification Estimates) 110

Certified: 40-49 points Silver: 50-59 points Gold: 60-79 points Platinum: 80+ points

© Verdacity, LLC

* Note that an ideal certification range should be 3-6 points above the target certification threshold level

L= Likely, U = Unlikely

SECTION 01 91 19 – BUILDING ENVELOPE COMMISSIONING

PART 1 – GENERAL

1.0 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Section "General Commissioning Requirements" and other Division 01 Specification Sections as applicable to this section.

B. Division 3 through 9 Sections for building envelope commissioning requirements specific to the Work of each section.

1.1 SUMMARY

A. Commissioning: A systematic process of ensuring that all building envelope systems perform interactively according to the Architect's Basis of Design (BOD) and Owner's Performance Requirements (OPR). This is to be achieve through verification of installation and systems performance during the construction period.

B. The work under this Section is subject to the requirements of the Contract Documents including Owner's General Conditions.

C. The work under this Section and all related section shall meet the requirements set forth by LEED EA Prerequisite 1: Fundamental Commissioning and Verification and LEED EA Credit 1 Option 2: Envelope Commissioning.

D. It should be understood by all parties to this project that:

1. Compliance with the building envelope performance requirements set forth by the Owner in the Owner's Project Requirements (OPR) the Architect in the Basis-of-Design (BOD) for this project will be required to achieve successful commissioning of the building envelope.
2. The requirements of this Section shall in no way relieve the Owner, Contractor, Architect and other parties of their respective contractual obligations to the Owner for meeting the specified performance levels in the design and construction of this project.
3. The commissioning requirements of the general contractor and sub-contractor or trade responsible for the final detailing and construction of the building envelope are included in the technical specification Sections included in this Project Manual (Divisions 3 through 9).

E. Any changes to the contract documents arising out of the Building Envelope Commissioning Program must be submitted, reviewed and accepted in writing by the Architect and Owner.

F. This Section includes requirements for non-structural commissioning of the building envelope. Refer to Divisions 3 through 9 for specific commissioning requirements for each building envelope element and system. Systems to be commissioned:

1. Roof systems including all penetrations, transitions, etc.
2. Skylights and other sloped glazing
3. Exterior systems, including the air barrier system, water management systems and thermal barrier
4. Windows systems including curtain walls or storefront
5. Doors, louvers
6. Sealant joints, control joints and building expansion joints
7. Flashings, including all transitions, end-dams, etc.
8. Below-grade waterproofing/damp proofing or vapor barriers
9. Interface conditions between each of the above listed elements

1.2 COMMISSIONING TEAM

A. Owner / Owner's Representative and Owner's Consultants
B. General Contractor
C. Architect and Design Engineers
D. Building Envelope Commissioning Agent (BECxA)
E. Building envelope contractors and subcontractors

F. Building Envelope Testing Agency

1.3 BUILDING ENVELOPE COMMISSIONING AGENT (BECxA)

A. The Building Envelope Commissioning Program will be managed by a registered architect, professional engineer, or other certified commissioning entity (Building Envelope Commissioning Agent) retained by the Owner. The Building Envelope Commissioning Program will include, by reference, all requirements set forth by the Architect for preconstruction laboratory and field performance testing of the materials, components, systems and assemblies that comprise the building envelope.

B. The Building Envelope Commissioning Agent, person or party, shall possess the experience and technical qualifications as outlined in ASTM E2947 and ASTM E2813 to design, critique, validate and support the team in the project development and construction validation, and shall be deemed an expert in the building enclosure systems anticipated to be used on the proposed building.

1.4 BUILDING ENVELOPE COMMISSIONING AGENT'S RESPONSIBILITIES

A. Review project drawings and specifications, at milestones as specified in the Building Envelope Commissioning Plan, for constructability, durability performance and exterior envelope conformance. Provide written comments to the Architect for review.

B. Write project specific commissioning plan. A construction-phase commissioning plan will be produced and distributed after the BECxA has received Contractor furnished submittal data.

C. Provide project-specific construction checklists and functional performance test protocols prior to the start of construction after receipt of submittal and other requested data, for review by Architect, General Contractor and subcontractors.

D. Review submittals, product data and shop drawings for compliance with Contract Documents.

E. Attend and participate in Pre-construction commissioning meetings, construction-phase commissioning coordination meetings, and pre-construction meetings for relevant exterior envelope trades.

F. Conduct period Construction Observations to review exterior envelope work for compliance with Contract Documents. Provide reports of the work in progress for each site visit during the construction of the building envelope. Deficiencies and non-conformances will be noted and logged in the Issues Log.

G. Review construction checklists implemented by General Contractor's QA/QC.

H. Maintain Issues Log of observed and reported deficiencies, non-conformances and discrepancies. Review or inspect repairs of items on Issues Log.

I. Develop procedures and protocols for functional performance testing.

J. Perform and document or witness and document functional performance testing as outlined in the Building Envelope Commissioning Plan.

K. Provide final report documenting Building Envelope Commissioning Program as outlined below under Commissioning Documentation.

L. Post Occupancy: Attend 10-month warranty review inspection as required in Division 01 and per LEED requirements.

M. BECxA is not authorized to:
1. Release, revoke, alter or expand requirements of Contract Documents.
2. Approve or accept any portion of the work.
3. Perform any duties of the Contractor

1.5 GENERAL CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with the Commissioning Agent personnel, provide access to work, and provide adequate schedule for the work for commissioning tasks.

B. Furnish copies of all shop drawings, manufacturer's literature, installation instructions, maintenance information, schedules, warranties or other information as requested.

C. Quality Assurance Program:
1. Submit a copy of the General Contractor's project and site-specific Quality Assurance Program for Construction for review by the Architect, the Owner and Owner representatives, and the Commissioning Agent prior to beginning construction and prior to the kick-off meeting of the Building Envelope Commissioning Program. The Quality Assurance Program shall identify responsible parties and proposed schedule for field quality control inspections.
2. Perform field quality control inspections utilizing construction checklists and submit reports on envelope construction to the BECxA, including documentation of observed deficiencies for inclusion in the Issues Log.
3. Provide a repair and remediation protocol for any systemic failures identified by the BECxA or observed during field quality control inspections, including a timeline for repair of all affected elements. Repaired elements shall not be covered up without documentation and review by the BECxA.

D. Schedule and participate in pre-construction and construction-phase commissioning coordination meetings. Attend and participate in testing and inspection procedure meetings. Ensure that subcontractors and their field foremen attend meetings relevant to their trade, either directly or at areas of interface with adjacent construction.

E. Provide test data, letters of incompatibility and certificates to the BECxA.

F. Provide schedule of field functional performance tests and inspections required by the Construction Documents. Incorporate Building Envelope Commissioning activities into the Master Construction Schedule.

G. Facilitate functional performance testing as outlined in the Building Envelope Commissioning Plan and specific Functional Performance Test Procedures.

H. Permit BECxA to access locations of installed systems, subsystems and components for inspection.

I. Participate in maintenance orientation and inspection and training sessions.

J. Provide BECxA with required documentation for Systems Manual as outlined in Commissioning Documentation section below.

1.6 ARCHITECT / ENGINEER RESPONSIBILITIES

A. Provide electronic copies of project drawings and specifications to the BECxA.

B. Provide written responses to design review comments from the BECxA or other parties as requested.

C. Attend design, pre-construction and construction-phase coordination meetings.

D. Participate in testing procedures meetings.

E. Provide resolution for items for which the Contractor and BECxA may be in disagreement.

1.7 COMMISSIONING DOCUMENTATION

A. General Contractor will provide the following information to BECxA for inclusion in the Systems Manual.

1. Submittals, information for system manuals and other required documents and reports.
2. Systems Manual information shall include a master product list for all major building envelope materials and systems, including for each:
Product name, manufacturer and manufacturer's contact information, product color, supplier contact information, installation instruction, manufacturer's product maintenance guide and checklist for periodic review of the product indicating how often the product should be inspected and process for repair
3. Identification of installed envelope components, assemblies systems and equipment, including design changes that occurred during the construction phase.
4. Test and inspection reports and certificates.
5. Corrective action documents such as photographic documentation of repaired deficiencies.

B. BECxA will provide:

1. Regular reports to the Owner and distribute to other parties as requested by the Owner, as construction and commissioning progresses.
2. Final summary report of the Commissioning Program and letter of compliance to the Owner upon completion of exterior envelope construction and resolution of all deficiencies or non-conforming items. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc. will be compiled in appendices and provided with the summary report.

1.8 SUBMITTALS

A. The Contractor is to provide the following submittals to the BECxA in addition to submitting them to the Architect.

1. Coordination Drawings: Provide cross references on any and all shop drawings

indicating that drawings have been checked and cross-referenced by the Contractor to ensure that adjacent elements (i.e. wall elements and fenestration elements) and the dimensions and construction tolerances indicated will allow all work at interfaces to be constructible

2. Qualifications Data: For fabricators, installers, and testing agencies, submit to the Building Envelope Commissioning Agent for review all qualifications required in Divisions 3 through 9 for review.
3. *FOR PROJECTS WITH MOCK-UPS: Preconstruction Test Reports: all preconstruction air and water leakage performance test results, including all failed tests, recording the noted deficiency and the required repair, and provide a copy of all remediation processes and QC/QA processes that will be put in place to address the deficiency on future work product*
4. Source Quality Control Reports: Retain a copy for field review by the Building Envelope Commissioning Agent and include in the closeout submittal a copy of all manufacturer QA/QC and laboratory reports submitted for products supplied for the project.
5. Field Quality Control Reports: Provide a copy of the test reports for all field water and air penetration and other appropriate building envelope tests completed, and all Quality Assurance inspection reports.
6. Special Inspections Reports for all special inspections indicated by the Architect/ Engineer in the specifications.

1.9 MEETINGS

A. Pre-construction Commissioning Conference: The General Contractor will schedule a preconstruction commissioning conference prior to the commencement of construction of the building envelope, at a time convenient to the Owner, BECxA, Contractor and subcontractors, and Architect. The BECxA will conduct the meeting to review commissioning responsibilities and personnel assignments.
   1. Attendees: Owner, BECxA, CxA, Architect and consultants, General Contractor, building envelope subcontractors and site foremen, and other relevant parties shall attend the conference.
   2. General Contractor will record and distribute meeting minutes.

B. Construction Phase Commissioning Meetings:
   1. Schedule regular construction-phase commissioning coordination meetings as outlined in the Building Envelope Commissioning Plan.
   2. Review coordination, deficiency resolution, and planning issues with specific subcontractors and their foremen.
   3. Attendees: BECxA, General Contractor, building envelope subcontractors and site foremen, and other relevant parties.

C. Post-Occupancy: BECxA shall participate in one warranty period site visit within the year following substantial completion.

1.10 FUNCTIONAL PERFORMANCE TESTING

A. Objective and scope: The objective of functional performance testing is to demonstrate that envelope assemblies and systems, interfaces and transitions are functioning according to the documented the Contract Documents and in accordance with the OPR. During the testing process, areas of non-compliant performance are identified and corrected, improving the operation and functioning of the building envelope assemblies.

B. Development of Test Procedures: The BECxA shall develop specific test protocols and procedures to verify and document proper operation of envelope assemblies, transitions and interfaces. The Architect, General Contractor and subcontractors shall review these

protocols and procedures for feasibility and warranty protection.

C. Functional performance tests of building envelope assemblies shall be performed by the BECxA, by a qualified testing agency approved by the Owner and/or the BECxA, or by the Contractor, as outlined in the Building Envelope Commissioning Plan.

D. Functional Performance Testing Requirements: See requirements in the individual specification sections in Divisions3 through 9.

E. General Contractor and their subcontractors shall provide sufficient notice to the BECxA regarding their completion schedule for the construction of the assemblies or exterior envelope systems. Functional performance tests shall be scheduled through the General Contractor.

F. General Contractor shall certify that building envelope systems, subsystems, and construction have been completed according to the Contract Documents, including all addenda and change order requirements.

G. General Contractor shall perform out-of-sequence work as may be required to facilitate functional performance tests.

H. Deferred Testing: If field tests cannot be completed because of a deficiency outside the scope of the building envelope, the deficiency shall be documented and reported to the Owner and the Architect. Deficiencies shall be resolved and corrected by appropriate parties and the test rescheduled.

I. The BECxA may recommend solutions to problems found; however the burden of responsibility to solve, correct and re-test problems is with the Contractor, subcontractors and the Architect.

1.11 NON-CONFORMANCE

A. All deficiencies or non-conformance issues shall be noted on the Issues Log and reported by the BECxA to the Contractor and Architect.

B. Corrections of minor deficiencies identified during functional performance testing or inspections may be made at the time of testing/inspection at the discretion of the BECxA. In such cases, the deficiency and resolution will be documented.

1.12 TEST REPORTS

A. Testing reports shall include measured data, data sheets, and a comprehensive summary describing the specific building envelope systems at the time of testing.

B. Deficiencies will be evaluated by the Architect and the BECxA to determine corrective action. Deficiencies shall be corrected and test repeated. All repairs are to be documented by the Commissioning Agent.

C. Re-test deficient systems in accordance with the test specific protocol.

D. Where repair and/or re-testing is not feasible and it is determined that the system is constructed according to the Contract Documents, the Owner will decide whether modifications are required to bring the performance of the system to a level where the failure or deficiency is eliminated and shall be implemented or if the test results will be accepted as submitted. If corrective Work is performed, the Owner will decide if tests shall be repeated and a revised report is to be submitted.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 01 91 19

SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. The extent of formwork is indicated by the cast-in-place concrete structures shown on the Drawings.

B. The Work includes providing formwork, and shoring, for cast-in-place concrete and installation into formwork of items furnished by others, such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, nosings, and other items to be embedded in concrete (but not including reinforcing steel).

1.2 REFERENCES

A. American Concrete Institute:

1. ACI 117, Specifications for Tolerances for Concrete Construction and Materials
2. ACI 301, Specifications for Structural Concrete
3. ACI 315, Detail and Detailing of Concrete Reinforcement
4. ACI 318, Building Code Requirements for Structural Concrete
5. ACI 347R, Guide to Formwork for Concrete

B. Concrete Reinforcing Steel Institute, CRSI Manual of Standard Practice

C. American Society for Testing Materials (ASTM)

1. ASTM C203, Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
2. ASTM D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics
3. ASTM D1751, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

1.3 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Product Data; Concrete Formwork: submit PDFcopy of manufacturer's data and installation instructions for proprietary materials including form coatings manufactured form systems, ties, accessories, and other items specified herein.

1.4 QUALITY ASSURANCE

A. The Installer must examine the substrate and the conditions under which concrete formwork is to be performed and notify the Architect in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Codes and Standards: Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute Standard ACI 347R, "Guide to Formwork for Concrete."

C. Allowable Tolerances:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347R and as follows:

a. Variation from plumb in lines and surfaces of columns, piers, walls, and arises; 1/4 inch per 10 feet, but not more than one inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4 inch in a bay or 20 feet maximum; 1/2" maximum in 40 ft. or more.
b. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4 inch.

c. Variations in footings plan dimensions, minus 1/2 inch and plus 2 inches; misplacement or eccentricity, 2 percent of the footing width in direction of misplacement but not more than 2 inches; thickness reduction, minus 5 percent.

2. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and locations of concrete members and stability of forming systems.
3. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed Work will be within specified tolerances.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete

1. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed, plywood-faced, or other panel type materials acceptable to Architect, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practicable sizes to minimize number of joints to conform to joint system shown on Drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

a. Plywood: APA grade-trademarked "B-B Plyform Exterior," mill oiled.

B. Forms for Unexposed Finish Concrete

1. Form concrete surfaces which will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and one side for tight fit.

C. Cylindrical Forms

1. Form round-section members of heavy glass-fiber reinforced plastic or galvanized steel sheets. Butt sections together with bolted or keyed joints. Finish interior joints of forms smooth so there is no visible seam on finished concrete surfaces.
2. Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax impregnated exterior for weather and moisture protection.

a. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
b. Provide manufacturer's standard plastic-lined-interior units.

D. Form Units

1. Provide factory-fabricated, adjustable-length, removable, or snap-off metal form ties; design to prevent form deflection and to prevent spalling concrete surfaces upon removal.
2. Unless otherwise shown, provide ties so that the portion remaining within concrete after removal of exterior parts is at least one inch from outer concrete surface. Unless otherwise indicated, provide form ties which will leave a hole not larger than one-inch diameter in concrete surfaces.
3. Form ties fabricated on the project site and wire ties are not acceptable.

E. Form Coatings

1. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

F. Inserts

1. Provide metal inserts for anchorage of materials or equipment to concrete construction not supplied by other trades and as required for the Work.
2. Provide Fry original reglet as manufactured by Fry Reglet Corporation, Alhambra, California. Reglet shall be made of .050 polyvinylchloride, meeting ASTM Spec. D-1874. Provide steel spacer channel for positive alignment and barrier to grout.

3. Vinyl Chamfer Strips: Shall be Vinylex CSN-3/4 as manufactured by Vinylex Corporation, Knoxville, Tennessee.

2.2 DESIGN OF FORMWORK

A. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork and construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

C. Construct forms to sizes, shapes, and lines, and dimensions shown to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

D. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses and the like for easy removal.

E. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joint and provide backup material at joints as required to prevent leakage and fins.

F. Provide temporary openings for cleanouts and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exposed corners and edges as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Re-tighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Provisions for other Trades: Coordinate openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

PART 3 EXECUTION

3.1 FORM CONSTRUCTION

A. Construct forms complying with ACI 347R to the exact sizes, shapes, lines, and plumb work in finish structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible, consistent with project requirements.

   1. Form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.

D. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

E. Falsework:

   1. Erect falsework and support, brace and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
   2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work or required dimensions.
   3. Support form facing materials by members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.
   4. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads for long span members without intermediate supports.
   5. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimension.

F. Forms for Exposed Concrete

   1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
   2. Do not use metal cover plates for patching holes or defects in forms.
   3. Provide sharp, clean corners at intersecting planes without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
   4. Use extra studs, whalers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
   5. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
   6. Form molding shapes, recesses, and projections with smooth-finish materials and install in forms with sealed joints to prevent displacement.

G. Corner Treatment

   1. Form chamfers with 3/4-inch x 3/4-inch strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
   2. Unexposed corners may be formed either square or chamfered.

H. Provision for Other Trades

   1. Provide openings in concrete formwork to accommodate work of other trades including those under separate prime contracts. Size and location of openings, recesses, and chases are the responsibility of the trade requiring such items. Accurately place and securely support items to be built into form.

I. Cleaning and Tightening

   1. thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

J. Construction Joints

1. Where footings and walls are divided by construction joints, joints shall have keyways formed. Keyways shall be 1/3 of the dimension of the element in both directions and shall be at least 2 inches thick.

3.2 FORM COATINGS

A. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come in contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Set and build into the Work anchorage devices and other embedded items required for other Work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge form or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

1. Forms for concrete curbs and bases shall be rigidly held straight and tight so that finished concrete will be level and even.

3.4 REMOVAL OF FORMS

A. Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the Work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation; and provided that curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 14 days, and not until concrete has attained design minimum 28-day compressive strength.

C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.5 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to the Architect.

END OF SECTION

SECTION 031005

CONCRETE FORMING AND ACCESSORIES (RETAINING WALL)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Formwork for cast-in-place concrete.
2. Shoring, bracing, and anchorage.
3. Architectural form liners.
4. Form accessories.
5. Form stripping.

1.2 SUBMITTALS

A. Product Data: Manufacturer information on void form materials and installation requirements.

B. Shop Drawings:
1. Formwork, shoring, and reshoring.
2. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
3. Means of leakage prevention for concrete exposed to view in finished construction.
4. Sequence and timing of erection and stripping, assumed compressive strength at time of stripping, height of lift, and height of drop during placement.
5. Vertical, horizontal, and special loads according to ACI 347, and camber diagrams if applicable.
6. Notes to formwork erector showing size and location of conduits and piping embedded in concrete according to ACI 318.
7. Procedure and schedule for removal of shores and installation and removal of reshores.

C. Manufacturer's Certificate: Products meet or exceed specified requirements.

D. Delegated Design Submittals:
1. Submit signed and sealed Shop Drawings with design calculations and assumptions for formwork, shoring, and reshores.
2. Indicate loads transferred to structure during process of concreting, shoring, and reshoring.
3. Include structural calculations to support design.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

F. Qualifications Statement:
1. Qualifications for licensed professional.

1.3 QUALITY ASSURANCE

A. Perform Work according to ACI 318.

B. For wood products furnished for Work of this Section, comply with AF&PA.

C. Perform Work according to applicable building codes.

D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Texas.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Design, engineer, and construct formwork, shoring, and bracing according to ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line, and dimension as indicated in construction documents.

B. Vapor Retarder Permeance: Maximum 1 perm when tested according to ASTM E96.

2.2 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

2.3 COATINGS

A. Coatings for Aluminum:
   1. Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate.
   2. One coat primer and one coat finish.
   3. Minimum Total Dry Film Thickness: Per manufacturer’s recommendations.

2.4 FORMWORK ACCESSORIES

A. Form Ties:
   1. Type: Snap off.
   2. Material: Galvanized.
   3. Length: Fixed.
   4. Furnish waterproofing washer.

B. Spreaders:
   1. Description: Standard, non-corrosive metal-form clamp assembly, of type acting as spreaders and leaving no metal within 3 inches of concrete face.
   2. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Release Agent:
   1. Description: Colorless mineral oil that will not stain concrete or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.

D. Corners:
   1. Type: Chamfer.
   2. Size: ¾ inch by ¾ inch..
   3. Lengths: Maximum possible.

E. Dovetail Anchor Slot:
   1. Material: Galvanized steel.
   2. Filling: Foam.
   3. Fasten slot to concrete formwork according to manufacturer instructions, and insert foam filler to prevent concrete from entering slot during pour.

F. Flashing Reglets:
   1. Material: Galvanized steel.
   2. Lengths: Maximum possible.
   3. Furnish alignment splines for joints.
   4. Filling: Foam.
   5. Fasten flashing reglet to concrete formwork according to manufacturer instructions, and insert foam to prevent concrete from entering reglet during pour.

G. Vapor Retarder:
   1. Description: Polyethylene sheet.
   2. Thickness: 15 mils.

H. Bituminous Joint Filler: Comply with ASTM D1751.

I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.

J. Waterstop:

K. Waterstop:
   1. Description: Flexible strip of bentonite waterproofing compound in coil form for joints in concrete construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork.

B. Verify that dimensions agree with Shop Drawings.

C. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect/Engineer before proceeding.

3.2 INSTALLATION

A. Earth Forms:
   1. Trench earth forms at least 3 inches wider than footing widths indicated on Drawings.
   2. Construct wood edge strips at top of each side of trench to secure reinforcing and to prevent trench from sloughing.

B. Formwork:
   1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
   2. Positioning:
      a. Verify horizontal and vertical positions of forms.

b. Correct misaligned or misplaced forms before placing concrete.
3. Complete wedging and bracing before placing concrete.
4. Erect formwork, shoring, and bracing to achieve design requirements according to ACI 318.
5. Stripping:
   a. Arrange and assemble formwork to permit dismantling and stripping.
   b. Permit removal of remaining principal shores.
6. Obtain approval of Architect/Engineer before framing openings in structural members not indicated on Drawings.
7. Install chamfer strips on external corners of beams, joists, and columns.
8. Install void forms according to manufacturer instructions.
9. Do not reuse wood formwork more than one times for concrete surfaces to be exposed to view.
10. Do not patch formwork.
11. Leave forms in place for minimum number of days according to ACI 347.

C. Form Removal:
1. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads, and removal has been approved by Architect/Engineer.
2. Form Release Agent:
   a. Apply according to manufacturer instructions.
   b. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
   c. Do not apply form release agent if concrete surfaces are indicated to receive special finishes or applied coverings that may be affected by agent.
   d. Soak inside surfaces of untreated forms with clean water, and keep surfaces coated prior to placement of concrete.
3. Form Cleaning:
   a. Clean formed cavities of debris prior to placing concrete.
   b. Flush with water or use compressed air to remove remaining foreign matter.
   c. During cold weather, remove ice and snow from within forms without using de-icing salts, and use compressed air or other dry method to remove foreign matter.
4. Reuse and Coating of Forms:
   a. Thoroughly clean forms and reapply form coating before each reuse.
   b. For exposed Work, do not reuse forms with damaged faces or edges.
   c. Apply form coating to forms according to manufacturer instructions.
   d. Do not coat forms for concrete indicated to receive "scored finish."
   e. Apply form coatings before placing reinforcing steel.

D. Forms for Smooth Finish Concrete:
1. Use steel, plywood, or lined-board forms.
2. Install form lining with close-fitting square joints between separate sheets without springing into place.
3. Use full-sized sheets of form liners and plywood wherever possible.
4. Tape joints to prevent protrusions in concrete.
5. Apply forming and strip wood forms in a manner to protect corners and edges.
6. Keep wood forms wet until stripped.

E. Architectural Form Liners:
1. Erect architectural side of formwork first.
2. Attach form liner to forms before installing form ties.
3. Seal form liner joints to prevent grout leaks.
4. Dress joints and edges to match form liner pattern and texture.

F. Forms for Surfaces to Receive Membrane Waterproofing:
   1. Use plywood or steel forms.
   2. After erection of forms, tape form joints to prevent protrusions in concrete.

G. Framing, Studding, and Bracing
   1. Size framing, bracing, centering, and supporting members for sufficient strength to maintain shape and position under imposed loads from construction operations.
   2. Distribute bracing loads over base area on which bracing is erected.

H. Form Anchors and Hangers:
   1. Do not use anchors and hangers leaving exposed metal at concrete surface.
   2. Symmetrically arrange hangers supporting forms from structural-steel members to minimize twisting or rotation of member.
   3. Penetration of structural-steel members is not permitted.

I. Inserts, Embedded Parts, and Openings:
   1. Install formed openings for items to be embedded in or passing through concrete Work.
   2. Locate and set in place items required to be cast directly into concrete.
   3. Position recessed reglets for brick veneer masonry anchors according to spacing and intervals as indicated on Drawings.
   4. Joints:
      a. Install waterstops continuous without displacing reinforcement.
      b. Heat-seal joints watertight.
   5. Provide temporary ports or openings at bottom of formwork as required to facilitate cleaning and inspection.
   6. Close temporary openings with tight-fitting panels, flush with inside face of forms, and neatly fitted such that joints will not be apparent in exposed concrete surfaces.

J. Form Ties:
   1. Provide sufficient strength and quantity to prevent spreading of forms.
   2. Leave inner rods in concrete when forms are stripped.
   3. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless indicated otherwise on Drawings.

K. Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

L. Construction Joints:
   1. Install surfaced pouring strip where construction joints intersect on exposed surfaces to provide straight line at joints.
   2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
   3. Appearance:
      a. Show no overlapping of construction joints.
      b. Construct joints to present same appearance as butted plywood joints.

M. Embedded Items:
   1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features.
   2. Do not embed wood or uncoated aluminum in concrete.
   3. Obtain installation and setting information for embedded items furnished under other Sections.
   4. Securely anchor embedded items in correct location and alignment prior to placing concrete.

5. Ensure that conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 regarding size and location limitations.

N. Openings for Items Passing through Concrete:
1. Frame openings in concrete where indicated on Drawings.
2. Establish exact locations, sizes, and other conditions required for openings and attachment of Work specified under other Sections.
3. Coordinate Work to avoid cutting and patching of concrete after placement.
4. Perform cutting and repairing of concrete required as result of failure to provide required openings.

O. Screeds:
1. Set screeds and establish levels for tops of and finish on concrete slabs.
2. Slope slabs to drain as required or as indicated.

P. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle-, pad-, or base-type screed supports that will not puncture membrane.
2. Staking through membrane is not permitted.

Q. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.
2. Thoroughly blow out forms with compressed air just before concrete is placed.

3.3 TOLERANCES

A. Construct formwork to maintain tolerances according to ACI 318.

3.4 FIELD QUALITY CONTROL

A. Inspection:
1. Inspect erected formwork, shoring, and bracing to ensure that Work complies with formwork design and that supports, fastenings, wedges, ties, and items are secure.
2. Notify Architect/Engineer after placement of reinforcing steel in forms but prior to placing concrete.
3. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 2000

CONCRETE REINFORCING

PART 1 GENERAL

1.1 SUMMARY

A. The extent of concrete reinforcement is shown on the Drawings and in schedules.

B. The Work includes fabrication and placement of reinforcement for cast-in-place concrete including bars, welded wire fabric, ties, and supports.

1.2 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Product Data.

1. Submit manufacturer's specifications and installation instructions for proprietary materials and reinforcement accessories.

C. Shop Drawings

1. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315- Latest Edition "Manual of Standard Practice for Detailing Reinforced Concrete Structures." Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements, and assemblies as required for the fabrication and placement of concrete reinforcement. Show building plans with bar sizes, spacing, and quantities for all bent and straight reinforcing bars. Show wall reinforcing steel in elevation.

1.3 QUALITY ASSURANCE

A. The Installer must examine the substrate and the conditions under which concrete reinforcement is to be placed and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Codes and Standards: Comply with requirements of the latest edition of the following codes and standards, except as herein modified:

1. American Welding Society, AWS D1.1 and D1.4
2. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
3. American Concrete Institute, ACI 318-11 "Building Code Requirements for Structural Concrete."

1.4 DELIVERY, HANDLING, AND STORAGE

A. Deliver reinforcement to the project site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

PART 2 PRODUCTS

2.1 MATERIAL

A. Reinforcing Bars (Rebar, ReBar): ASTM A615, and ASTM A706 and as follows.

1. Provide Grade 60 for bars No. 3 to 11, except as otherwise indicated.

B. Steel Wire: ASTM A82.

C. Supports for Reinforcement (including welded wire fabric): Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place.

1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
3. Over waterproof membranes, use precast concrete chairs to prevent penetration of the membrane
4. For footings, trench footings, and grade beams use precast concrete bricks (f'c = 3000 psi min. at 28 days). (Concrete masonry bricks not acceptable).
5. For concrete masonry bond beams use #2 bar laterally, tied to each longitudinal reinforcing bar below to hold bars apart and up from bottom. Space #2 bars at 48 inches on center.

2.2 FABRICATION

A. Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice." In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the work.

1. Bar lengths, depths, and bends exceeding specified fabrication tolerances.
2. Bends of kinks not indicated on Drawings or final shop drawings.
3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 EXECUTION

3.1 EXAMINATION

A. The installer must examine the conditions under which concrete reinforcement is to be placed and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. The Engineer shall be notified by the Contractor when steel placement for a concrete pour is nearing a completion so that the Work may be observed.

3.2 INSTALLATION

A. Comply with the specified codes and standards and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Position, support, and secure reinforcement against displacement by formwork construction, or concrete placement operations. Locate and support reinforcing by precast concrete brick, metal chairs, runners, bolsters, spacers, and hangers as required.

D. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with min 19-gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

E. Install welded wire fabric in as long lengths as practicable. Lab adjoining pieces at least one full mesh and lace splices with min 19-gauge wire. Do not make end laps midway between supporting beams or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.

F. Provide sufficient numbers of supports and of strengths to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runaways for concrete conveying equipment and similar construction loads.

G. Provide standard reinforcing splices by lapping ends, placing bars in contact, and tightly tying wire. Comply with requirements of ACI 318 for minimum lap of spliced bars.

H. Reinforcing steel installed in continuous footings shall run continuous. This shall include specially shaped components with proper lap where corner reinforcing and step footings occur.

I. Provide additional reinforcing around required openings in footings, and slabs having at least a one-foot dimension.

J. Locate reinforcement and other items to avoid conflict with the work of other trades. Provide additional reinforcement around openings as shown. Do not cut or remove reinforcement for any reason without the prior approval of the ENGINEER.

K. Continuity of Horizontal Reinforcement.

1. Footings, walls, turned-down slab edges: Bars shall be lapped not less than 32 bar diameters or 24 inches except where larger splices lengths are shown or required to create a Class B lap splice per ACI 318. Except where bar lengths are given, reinforcement is to be continuous for full length or width of member less required concrete covers. Do not splice transverse footing bars. Additional reinforcement shall be provided at corners, intersections and other discontinuities as shown on the drawings.
2. Elevated concrete slabs: Welded wire fabric shall be lapped not less than one and one half meshes or 8 inches on all sides.

END OF SECTION

SECTION 032005

CONCRETE REINFORCING (RETAINING WALL)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

1.2 SUBMITTALS

A. Shop Drawings:
1. Bar sizes, spacings, locations, splice locations, and quantities of reinforcing steel and welded wire fabric.
2. Bending and cutting schedules.
3. Supporting and spacing devices.

B. Manufacturer's Certificate: Products meet or exceed specified requirements.

C. Submit certified copies of mill test report of reinforcement materials analysis.

D. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.

E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statement:
1. Welders: Qualify procedures and personnel according to AWS D1.1.

1.3 QUALITY ASSURANCE

A. Perform Work according to ACI 318.

B. Prepare Shop Drawings according to ACI SP-66.

C. Perform Work according to applicable codes.

D. Welders: AWS qualified within previous 12 months for employed weld types.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials according to manufacturer instructions.

B. Protection:

1. Protect materials from moisture by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.5 EXISTING CONDITIONS

A. Field Measurements:
1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:
1. Comply with ASTM A615.
2. Yield Strength: 60 ksi.
3. Billet Bars: Deformed.
4. Finish: Uncoated.

B. Welded Deformed Wire Fabric:
1. Comply with ASTM A1064.
2. Configuration: Flat sheets.
3. Finish: Uncoated.

2.2 FABRICATION

A. Fabricate concrete reinforcement according to applicable code.

B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks, and seismic hooks as indicated.

C. Form reinforcement bends with minimum diameters according to ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Weld reinforcement according to AWS D1.4.

F. Splicing:
1. If not indicated on Drawings, locate reinforcement splices at point of minimum stress.
2. Obtain approval of splice locations from Architect/Engineer.

2.3 ACCESSORY MATERIALS

A. Chairs, Bolsters, Bar Supports, and Spacers:
1. Size and Shape: To strengthen and support reinforcement during concrete placement conditions.
2. Furnish load-bearing pad on bottom to prevent vapor retarder puncture.

B. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather-Exposed Concrete Surfaces:
1. Size and Shape: To meet Project conditions.

C. Reinforcing Splicing Devices:
   1. Type: Exothermic welding type; full tension and compression.

2.4 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Certificate of Compliance:
   1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
   2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 INSTALLATION

A. Place, support, and secure reinforcement against displacement.

B. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.

C. Spacing:
   1. Space reinforcement bars with minimum clear spacing according to ACI 318.
   2. If bars are indicated in multiple layers, place upper bars directly above lower bars.

D. Maintain concrete cover around reinforcement according to ACI 318 and construction documents.

E. Splice reinforcing where indicated on Drawings according to manufacturer instructions.

3.2 TOLERANCES

A. Install reinforcement within following tolerances for flexural members, walls, and compression members per applicable standards and construction documents.

B. Foundation Walls: Comply with ACI 530/530.1.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed by Owner's testing laboratory according to applicable code.

B. Provide unrestricted access to Work and cooperate with appointed inspection and testing firm.

C. Reinforcement Inspection:
   1. Placement Acceptance: Inspect specified and ACI 318 material requirements and specified placement tolerances.
   2. Welding: Inspect welds according to AWS D1.1.

3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Weldability Inspection: Inspect for reinforcement weldability if formed from steel other than ASTM A706.
5. Continuous Weld Inspection: Inspect reinforcement according to applicable code.
6. Periodic Weld Inspection: Inspect other welded connections.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies interior and exterior cast-in-place concrete, mix design, placement procedures, and finishes. Work includes, but is not necessarily limited to:

1. Interior Concrete:

a. Floor slabs on grade, elevated slabs on metal deck.
b. Bases, risers, and steps, (elevated), (on grade)
c. Footings, pads, piers, columns, beams

2. Other Materials

a. Concrete admixtures
b. Expansion joint fillers
c. Non-slip aggregate finish
d. Curing materials
e. Self-leveling underlayment
f. Bonding agent
g. Concrete floor sealer

B. Provide other cast-in-place concrete and related work as shown on the Drawings and specified herein for complete and finished work, except concrete work specifically designated to be provided under the Work of other Sections of these Specifications.

C. The following is by other Sections, meeting the requirements of this Section (unless indicated otherwise).

1. Bases for exterior equipment.
2. Encasement of underground utilities or connections.
3. Specifically excluded items.

1.2 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Submit product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and other specified items.

C. Submit laboratory test reports for concrete materials and mix design tests.

D. Submit material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

E. Submit proposed mix designs.

F. Submit statement from ready-mixed plant verifying conformance to specifications and proposed mix designs.

G. Submit concrete curing materials product data and specification sheets.

1.3 QUALITY ASSURANCE

A. Refer to Division 1 for additional requirements.

B. Codes and Standards: Comply with the latest provisions of the following codes, specifications, and standards, except as otherwise shown or specified.

1. ACI 117 “Standard Tolerances for Concrete Construction and Materials.”
2. ACI 211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.”
3. ACI 301 “Specifications for Structural Concrete for Buildings.”
4. ACI 302.1R “Guide for Concrete Floor and Slab Construction.”
5. ACI 304R “Guide for Measuring, Mixing, Transporting, and Placing Concrete.”
6. ACI 311.4R “Guide for Concrete Inspection.”
7. ACI 318-08 “Building Code Requirements for Reinforced Concrete and Commentary.”
8. Concrete Reinforcing Steel Institute, “Manual of Standard Practice.”
9. ACI 305R “Hot Weather Concreting.”
10. ACI 306R “Cold Weather Concreting.”
11. ACI 308 “Standard Practice for Curing Concrete.”
12. ACI 309R “Guide for Consolidation of Concrete.”
13. ACI 315 “Details and Detailing of Concrete Reinforcement.”
14. ACI347R “Guide to Formwork for Concrete.”
15. ASTM C94 “Test Method for Compressive Strength of Cylindrical Concrete Specimens.”
16. ASTM C150 “Specification for Portland Cement.”
17. ASTM C260 “Specification for Air-Entraining Admixtures for Concrete.”
18. ASTM C309 “Specification for Liquid Membrane –Forming Compounds for Curing Concrete.”
19. ASTM C494 “Specification for Chemical Admixtures for Concrete.”
20. Comply with building code requirements which are more stringent than the above.

C. Materials may require testing and re-testing, as directed by the Engineer, at any time during the progress of the Work. Allow free access to material stockpiles and facilities. Tests shall be done at the Contractor’s expense.

D. Concrete curing materials shall be approved by the manufacturer of the product for the final finish material on the concrete slabs. Submit written approval/certification if requested by the Engineer.

E. Material manufacturers shall be ISO 9001/9002 registered or provide proof of documented quality assurance system. Quality system must be registered by an independent registrar who is accredited by the American National Standards Institute (ANSI-RAB) or by another internationally recognized body. ISO 9001/9002 certification or proof of documented quality assurance system shall be included with the material submittals.

1.4 PROJECT CONDITIONS

A. Trades requiring inserts and sleeves for their work shall furnish same for installation as Work under this Section. Delivery of inserts and sleeves for installation as Work under this Section shall be timed so as note to cause delay in the progress of this Work.

B. Installation requirements within this Specification Section are not intended to be restrictive and the Contractor is allowed when reviewed with the Engineer's field representative to adjust the means and methods used to meet required tolerances. Compliance with required tolerances is the responsibility of the Contractor and adjustment required to meet these shall not be unduly restricted by the Engineer or his representative.

1.5 CONCRETE TESTING

A. The Contractor shall cooperate and coordinate with the testing laboratory to perform field quality control testing during concrete work under Division 3.

B. Quality Control Testing During Construction: Perform sampling and testing for field quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
2. Slump: ASTM C143, one test for each concrete load at point of discharge, and one for each set of compressive strength test specimens.
3. Air Content: ASTM C231, pressure method; one for every other concrete load at point of discharge or when the indication of change requires.

4. Compression Test Specimens: ASTM C31, one set of 6 standard cylinders for each compressive strength test, unless otherwise directed.

    a. Cast and store 3 cylinders for laboratory cured test specimens and 3 field-cured test specimens as specified in ASTM C31.

5. Concrete Temperature: Test hourly when air temperature is 40 degrees F. and below and when 80 degrees F. and above; and each time a set of compressive test specimens is made.
6. Compressive Strength Tests: ASTM C39, one set for each 100 cu. yds. or fraction thereof, of each mix design placed in a day or for each 5,000 sq. ft. of surface area placed; 2 specimens (one field cured and one lab cured) tested at 7 days, 2 specimens (one field cured and one lab cured) tested at 28 days, and 2 specimens (one field cured and one lab cured) retained in reserve for later testing if required

    a. When the frequency of testing will provide less than 5 strength tests for a given mix design, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
    b. When the total quantity of a given mix design of concrete is less than 50 cu. yds., the strength tests may be waived by the Engineer if, in his judgment, adequate evidence of satisfactory strength is provided.
    c. When the strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

C. Report test results in writing to the Engineer, Contractor, and ready-mix supplier on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of Contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type and amount of fibrous reinforcement, compressive breaking strength, and type of break for both 7 day tests and 28 day tests.

D. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Engineer. The testing service shall conduct tests to determine the strength and other characteristics of the in-place concrete by compression tests on cored cylinders complying with ASTM C42 or by load testing specified in ACI 318 or other acceptable nondestructive testing methods, as directed. The Contractor shall pay for such tests conducted and other additional testing as may be required, when unacceptable concrete is verified.

E. Evaluation of Quality Control Tests: Do not use concrete delivered to the final point of placement which has slump or total air content outside the specified values.

    1. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of 3 consecutive compressive strength tests results equal or exceed the 28-day design compressive strength of the type or class of concrete; and no individual strength test falls below the required compressive strength by more than 500 psi.
    2. Strength tests of specimens cured under field conditions may be required by the Engineer to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded by the field quality control laboratory at the same time and from the same samples as the laboratory cured specimens.

        a. Provide improved means and procedures for protecting concrete when the 28-day compressive strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders.
        b. When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
        c. If individual tests of laboratory cured specimen produce strengths more than 500 psi below the required minimum compressive strength or if tests of field-cured cylinders indicate deficiencies in protection and curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate the load-bearing capacity may have been significantly reduced, tests of cores drilled from the area in question may be required.

3. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength.

F. Deficient concrete shall be removed as directed by the Engineer and replaced by the Contractor without additional cost to the Owner.

1.6 CONCRETE MATERIALS AND MIX DESIGN

A. Concrete Materials and Mix Design:

1. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94.
2. Product Data: Submit 2 copies of manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures, bonding agents, waterstops, joint systems, chemical floor hardeners, and dry shake finish materials.
3. Laboratory Test Reports: Submit 2 copies of laboratory test reports for concrete materials and mix design tests. The Engineer's review will be for general information only. Production of concrete to comply with specified requirements is the Contractor's responsibility.

B. Tests for Concrete Materials

1. For normal weight concrete test aggregates by the methods of sampling and testing of ASTM C33.
2. For light weight concrete, test aggregates by the methods of sampling and testing of ASTM C330.
3. For Portland cement, sample the cement and determine the properties by the methods of test ASTM C33.
4. Submit written reports for each material sampled and tested, prior to the start of Work. Provide the project identification name and number, date of report, name of Contractor, name of concrete testing service, source of concrete aggregates material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

C. Submit signed statement form ready-mix plant that concrete furnished for the Project will exactly conform to the approved design mixes.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type V or Type I-II modified cement for sulfate resistance.

1. Use one brand of cement throughout Project.

B. Fly Ash: ASTM C 618, Class C or F, may be substituted for up to 20 percent of the Portland cement in all concrete mixes unless noted otherwise.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Engineer.
3. Fine Aggregate: Clean, sharp, natural sand free from loam, clay lumps, or other deleterious substances.
4. Coarse Aggregate: Clean, un-coated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:

a. Crushed stone, processed from natural rock or stone.
b. Washed gravel, either natural or crushed. Use of pit or bank run gravels not permitted.
c. Maximum Aggregate Size: Not larger than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourths of minimum clear spacing between individual reinforcing bars or bundles of bars.

5. Aggregate Supply: Provide aggregates from one source of supply to ensure uniformity in color, size, and shape.
6. Alkali-Silica Reactivity: The contractor shall use aggregates that are not Alkali-Silica Reactive (ASR). Documentation shall be submitted for review certifying that aggregates are not potentially or known to be reactive.

D. Lightweight Aggregates: ASTM C 330.

E. Water: Potable.

2.2 CONCRETE ADMIXTURES

A. Provide admixtures produced by established reputable manufacturers and use in compliance with manufacturer's printed directions. Do not use admixtures which have not been incorporated and tested in accepted mixes, unless otherwise authorized specifically in writing by Engineer.

1. Air-Entraining Admixture: ANSI/ASTM C260
2. Water-Reducing Admixture: ANSI/ASTM C494, Type A.
3. Set-Control Admixture: ANSI/ASTM C494
4. Super Plasticizer: ANSI/ASTM C494, Type F.

B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Subject to compliance with requirements, provide one of the following:

a. “AEA-92 and Air Mix 200”, Euclid Chemical Co.
b. “MB-VR or MB-AE”, Master Builders, Inc.
c. “Sika AER”, Sika Corp.

C. Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.05 percent chloride ions.

1. Subject to compliance with requirements, provide one of the following:

a. “Eucon WR-75 or Eucon WR-91”, Euclid Chemical Co.
b. “Pozzolith Normal”, Master Builders, Inc.
c. “Plastocrete 160”, Sika Corp.

D. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and containing not more than 0.05 percent chloride ions.

1. Subject to compliance with requirements, provide one of the following:

a. “Eucon 37”, Euclid Chemical Co.
b. “Rheobuild 1000”, Master Builders, Inc.
c. “Sikament 300”, Sika Corp.

E. Water-Reducing, Accelerating Admixture: Non-chloride, non-corrosive per ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non-corrosive test data from and independent testing laboratory (of at least a year’s duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.

1. Subject to compliance with requirements, provide one of the following:

a. “Accelguard 80”, Euclid Chemical Co.
b. “Pozzutec 20”, Master Builders, Inc.

F. Water-Reducing, Retarding Admixture: ASTM C 494, Type D and contain not more than 0.05 percent chloride ions.

1. Subject to compliance with requirements, provide one of the following:

a. “Eucon Retarder 75”, Euclid Chemical Co.
b. “Pozzolith Retarder”, Master Builders, Inc.

c. “Plastiment”, Sika Corporation.

G. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Engineer.

H. Prohibited Admixtures: Calcium chloride or admixtures containing more than 0.05 percent chloride ions are not permitted.

2.3 PROPORTIONING AND DESIGN MIXES

A. Proportion mixes by either laboratory trial batch or field experience methods as specified in ACI 301, using materials to be employed on the project for each class of concrete required.

B. Submit written reports to Engineer of each proposed mix for each type of concrete at least 15 days prior to start of Work. Indicate with each mix design the items or structures for which it is to be used. Do not begin concrete production until mixes have been reviewed by Engineer. Submit the following information:

1. Complete identification of aggregate source of supply.
2. Tests of aggregate for compliance with specified requirements.
3. Scale weight of each aggregate.
4. Absorbed water in each aggregate.
5. Brand, type, and composition of cement.
6. Brand, type, and amount of each mixture.
7. Amounts of water used in trial mixes.
8. Proportions of each material per cu. yd. including fibrous secondary reinforcement.
9. Gross weight and yield per cu. yd. of trial mixtures.
10. Measured slump.
11. Measured air content.
12. Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7 and 28-day test, and for each design mix.
13. These test reports may be from previous projects within the past 6 months.
14. Identification number or name of mix to verify agreement with compression test reports.

C. Water-Cement Ratio Methods: Concrete proportions may be established by use of Water-Cement Ratio Limits Table 5.4 and limiting restrictions ACI 301.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Engineer before using in work.

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.
2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
4. Other concrete: Not more than 4 inches.

F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work. Adjustments must be made in writing to the Engineer. Only proceed when approval is granted.

G. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to the Engineer for preparing and reporting proposed mix designs. Trial batch and field experience tests shall have been performed within 12 months of submittal date.

2.4 CONCRETE CURING MATERIALS

A. Moisture-Retaining Cover: One of the following, complying with ANSI-ASTM C171 for concrete floors that are to be exposed or to receive floor sealer. Contractor's option to obtain specified requirements for concrete slabs-on-grade. Coordinate uses with finish material manufacturer's specifications.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

C. Water Based Acrylic Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class B, with 18 to 20 percent minimum solids.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Safe Cure and Seal, Dayton Superior Corp.
b. Aqua-Cure, Euclid Chemical Co.
c. Masterseal-W100, Master Builders, Inc.
d. Spartan Coate WBII, The Burke Group.

D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eucobar, Euclid Chemical Co.
b. E-Con, L&M Construction Chemicals, Inc.
c. Confilm, Master Builders, Inc.
d. Finishing Aid, The Burke Group.

E. Concrete curing materials shall be approved by the manufacturer of the product for the final finish on the concrete slabs. Submit written approval/certification.

2.5 SELF-LEVELING UNDERLAYMENT

A. Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch thick to feathered edges. (If required for patching and repairing).

B. Compressive strength: 4100 psi minimum at 28 days. Flexural strength: 1300 psi at 28 days. Tensile strength: 750 psi at 28 days. Shrinkage: .025 after 7 days.

C. Manufacturers:

1. "Thoro Underlayment": Thoro System Products, Centerville, Indiana.
2. "Ardex K-15": Ardex, Inc. Pittsburgh, Pennsylvania.
3. "300 Premium Underlayment": The Burke Group, Converse, Texas.

2.6 CONCRETE UNDERLAYMENT

A. One-component, cement based trowel grade underlayment. (if required for patching and repairing).

B. Material Properties:

1. Compressive strength: 4250 psi minimum at 28 days.
2. Flexural strength: 1000 psi minimum at 28 days.
3. Tensile strength: 650 psi minimum at 28 days.

C. Manufacturer:

1. "Thoro Underlayment Trowel Grade": Thoro System Products, Centerville, Indiana.
2. "Burke Feather Patch": The Burke Group, Converse, Texas.

2.7 BONDING AGENT

A. Chemical Bonding Agent: Film-forming, freeze-thaw resistant compound suitable for brush or spray application complying with MIL-B-19235. Subject to compliance with requirements, provide one of the following:

1. Adbond (J40); Dayton Superior Corp.
2. Eucoweld; Euclid Chemical
3. Everbond; L & M Construction Chemicals
4. Sonocrete; Sonneborn Building Products
5. Intralok; W.R. Meadows, Inc.
6. Acrylic Bondcrete, The Burke Group

2.8 CONCRETE PATCHING COMPOUND

A. Single-component, cement based, polymer modified patching mortar with low slump properties.

1. "Thorite 100" by Thoro System Products, Centerville, Indiana
2. “V/O Patch” by The Burke Group, Converse, Texas.

2.9 ADMIXTURES, GENERAL

A. Use air-entraining admixture in exterior concrete, unless otherwise indicated. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the following limits:

1. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:

a. 3 to 15 percent for maximum 2 inches aggregate.
b. 4-1/2 percent to 6-1/2 percent for maximum 1-inch aggregate.
c. 5 to 7 percent for maximum 3/4-inch aggregate.
d. 6 to 8 percent for maximum 1/2-inch aggregate.

2. Other Exterior Concrete: 2 to 4 percent

B. Use of admixtures for water-reducing and set-control shall be permitted only with prior approval of the Engineer for each condition and shall be in strict compliance with the manufacturer's directions.

1. Design mix submittals shall include these admixtures and shall indicate for which types of concrete structures they are to be used.

C. Use amount of admixtures recommended by manufacturer for climatic conditions prevailing at time of placing. Adjust quantities and types of admixtures as required to maintain quality control.

D. Use of calcium chloride will not be permitted.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
2. Delete the references for allowing additional water to be added to the batch for material with sufficient slump. Addition of water to the batch will not be permitted.
3. During hot weather or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 PREPARATION

A. Pre-placement Inspection: Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit the installation of their work; cooperate with other trades in setting such work, as required.

1. Inspect soil at bottom of foundation systems which will be subject to testing for soil bearing value by the testing laboratory, as directed by the Engineer. Place concrete immediately after approval of foundation excavations.
2. Inspect underslab drainage course areas that were subject to testing for soil bearing value by the testing laboratory as required by Engineer. Place concrete immediately after approval of underslab compaction tests.

B. Material placement for interior slabs on grade and exterior concrete stoops.

1. Under building slabs use satisfactory excavated or borrow material as indicated on the drawings.
2. Install and properly anchor the slab reinforcing mesh.

3.3 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Engineer.

B. Provide keyways where detailed at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Joint fillers and sealants are specified in Section 07920.

F. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts 1/8 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.

1. Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
3. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
4. Joint fillers and self-leveling sealants are specified in Section 07920.

G. Expansion Joints

1. Set and secure continuous expansion joint strips where edge of slab abuts vertical surfaces.
2. Extend joint fillers full-width and depth of joint, flush with finished surface. Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Form top edge of filler to conform to top profile of concrete.

3.4 INSTALLING EMBEDDED ITEMS

A. Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

C. Install dovetail anchor slots in concrete structures as indicated on drawings.

D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.5 PREPARING FORM SURFACES

A. Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

1. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints:

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

G. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineer.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth-Rubbed Finish: Provide smooth-rubbed finish on scheduled concrete surfaces that have received smooth-formed finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.

1. Combine one-part Portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white Portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.9 CONCRETE CURING AND PROTECTION

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material.

1. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified. Curing methods are contractor’s option to obtain finishes as required. Coordinate curing method with floor finish manufacturer. Do not use certain methods as may be required by the floor finish manufacturer.

D. Provide moisture curing by the following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Use continuous water-fog spray.
3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

E. Provide moisture-retaining cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Apply curing compound on exposed interior slabs as follows:

1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.
2. Concrete floor surfaces scheduled to receive tile installations shall have been moist cured; curing of these surfaces by sprayed chemical curing compounds is not permitted.

3.10 REMOVING FORMS

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after

placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.11 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Engineer.

3.12 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
2. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01-inch-wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and

expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs with prior approval of the Engineer for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.13 UNDERLAYMENTS

A. Install in strict accordance with manufacturer's written installation instructions and provide primers as recommended.

END OF SECTION

SECTION 033005

CAST-IN-PLACE CONCRETE (RETAINING WALL)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes Cast-in-Place Concrete for Following Items:
1. Building frame members.
2. Beams, lintels, and columns.
3. Shear walls.
4. Elevator shaft walls.
5. Retaining walls.
6. Foundation walls.
7. Footings.
8. Supported slabs.
9. Slabs on grade.
10. Control, expansion, and contraction joint devices.
11. Equipment pads.
12. Light pole base.
13. Flagpole base.
14. Thrust blocks.
15. Manholes.

1.2 SUBMITTALS

A. Product Data: Submit data on joint devices, attachment accessories, and admixtures.

B. Design Data:
1. Submit concrete mix design for each concrete strength.
2. Submit separate mix designs if admixtures are required for following:
a. Hot and cold weather concrete Work.
b. Air entrained concrete Work.
3. Identify mix ingredients and proportions, including admixtures.
4. Identify chloride content of admixtures and whether or not chlorides were added during manufacture.

C. Samples: Two samples of expansion/contraction joints and control joints.

D. Manufacturer's Certificate: Products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit installation procedures and interfacing required with adjacent Work.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.

1.4 QUALITY ASSURANCE

A. Perform Work according to ACI 318.

B. Comply with ACI 305R when pouring concrete during hot weather.

C. Comply with ACI 306.1 when pouring concrete during cold weather.

D. Acquire cement and aggregate from one source for Work.

E. Fire-Rated Wall, Floor, and Roof Construction:
   1. Rating: As indicated.
   2. Tested Rating: Determined according to ASTM E119.

F. Perform Work according to applicable codes and construction documents.

1.5 AMBIENT CONDITIONS

A. Maintain concrete temperature after installation per applicable codes.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Vapor Retarder Permeance: Maximum 1 perms when tested according to ASTM E96.

2.2 MATERIALS

A. Concrete:
   1. Cement:
      a. Comply with ASTM C150 and construction documents.
      b. Type: Portland.
      c. Furnish materials according to applicable codes.
   2. Air Entrainment: Comply with ASTM C260.
   3. Chemical:
      a. Comply with ASTM C494.
   4. Fly Ash: Comply with ASTM C618.
   5. Silica Fume: Comply with ASTM C1240.
   6. Slag:
      a. Description: Ground-granulated blast-furnace slag.
      b. Comply with ASTM C989.
   7. Plasticizing:
      a. Comply with ASTM C1017.

2.3 CONCRETE MIX

A. Select proportions for concrete according to ACI 318 trial mixtures and field test data.

B. Performance and Design Criteria:

   1. Per construction documents and applicable codes.

C. Admixtures:

1. Include admixture types and quantities indicated in concrete mix designs only if approved by Architect/Engineer.
2. Cold Weather:
   a. Use accelerating admixtures in cold weather.
   b. Use of admixtures will not relax cold-weather placement requirements.
3. Hot Weather: Use set-retarding admixtures.
4. Do not use calcium chloride or admixtures containing calcium chloride.
5. Add air entrainment admixture to concrete mix for Work exposed to freezing and thawing or deicing chemicals.
6. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fumes, and slag content as required by applicable code.

D. Average Compressive Strength Reduction: Not permitted.

E. Ready-Mixed Concrete: Mix and deliver concrete according to ASTM C94.

F. Site-Mixed Concrete: Mix concrete according to ACI 318.

2.4 ACCESSORIES

A. Bonding Agent:
   a. Furnish materials according to industry standards.

B. Vapor Retarder:
   a. Furnish materials according to construction documents.
   2. Type: As recommended for below-grade application.
   3. Joint Tape: As recommended by manufacturer.

C. Non-shrink Grout:
   a. Furnish materials according to construction documents.
   2. Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.
   3. Comply with ASTM C1107.
   4. Minimum Compressive Strength: 5,000 psi in 28 days.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Previously Placed Concrete:
   1. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
   2. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

3.3 INSTALLATION

A. Placing Concrete:
   1. Place concrete according to ACI 318.
   2. Notify testing laboratory and Architect/Engineer minimum 24 hours prior to commencement of operations.
   3. Ensure that reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
   4. Install vapor retarder under interior slabs on grade according to ASTM E1643.
   5. Repairs:
      a. Repair vapor retarder damaged during placement of concrete reinforcement.
   6. Joint Filler:
      a. Place joint filler in floor slab pattern placement sequence; set top to required elevations; secure to resist movement by wet concrete.
   7. Joint Devices:
      a. Coordination: Install construction joint devices in coordination with floor slab pattern placement sequence; set top to required elevations; secure to resist movement by wet concrete.
      b. Install joint device anchors, maintaining correct position to allow joint cover to be flush with floor and wall finish.
      c. Install joint covers in one-piece length when adjacent construction activity is complete.
   8. Deposit concrete at final position, preventing segregation of mix.
   9. Place concrete in continuous operation for each panel or section as determined by predetermined joints.
   10. Consolidate concrete.
   11. Maintain records of concrete placement, including date, location, quantity, air temperature, and test samples taken.
   12. Place concrete continuously between predetermined expansion, control, and construction joints.
   13. Do not interrupt successive placement and do not permit cold joints to occur.
   14. Place floor slabs in indicated saw-cut pattern.
   15. Saw-Cut Joints:
      a. Saw-cut joints within 12 hours after placing.
      b. Cut into 1/4 depth of slab thickness.
   16. Screeding:
      a. Screed floors and slabs on grade level.

B. Separate Floor Toppings:
   1. Prior to placing floor topping, remove deleterious material, roughen substrate concrete surface, and broom and vacuum clean.
   2. Place required dividers edge strips reinforcement and other items to be cast in concrete.
   3. Apply bonding agent to substrate.
   4. Place concrete floor toppings to required lines and levels.

C. Concrete Finishing:
   1. Provide formed concrete surfaces to be left exposed per construction documents and specifications.
   2. Finish concrete floor surfaces according to ACI 318.

3. Wood float surfaces receiving quarry tile, ceramic tile, terrazzo, and with full-bed setting system.
4. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin-set quarry tile, and thin-set ceramic tile.
5. Steel trowel surfaces indicated to be exposed.
6. In areas with floor drains, maintain floor elevation at walls and pitch surfaces uniformly to drains as indicated.

D. Curing and Protection:
1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Protect concrete footings from freezing per ACI 318.
3. Maintain concrete with minimal moisture loss at relatively constant temperature for period as necessary for hydration of cement and hardening of concrete.
4. Cure concrete floor surfaces as specified in Section.

5. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for seven days.

6. Spray water over floor slab areas and maintain wetness for seven days.

3.4 FIELD QUALITY CONTROL

A. Inspection and Testing: Performed by Owner's testing laboratory according to ACI 318.

B. Provide unrestricted access to Work and cooperate with appointed testing and inspection firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

D. Concrete Inspections:
1. Continuous Placement Inspection: Inspect for proper installation procedures.
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

E. Strength Test Samples:
1. Sampling Procedures: Comply with ASTM C172.
2. Sampling shall be performed per the construction documents.
3. Cylinder Molding and Curing Procedures:
   a. Comply with ASTM C31.
4. If volume of concrete for a class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches, or from every batch if less than five batches are used.
5. Make one additional cylinder during cold weather concreting and field cure.

F. Field Testing:
1. Slump Test Method: Comply with ASTM C143.
2. Air Content Test Method: Comply with ASTM C173.
3. Temperature Test Method: Comply with ASTM C1064.
4. Compressive Strength Concrete:
   a. Measure slump and temperature for each sample.
   b. Measure air content in air-entrained concrete for each sample.

G. Cylinder Compressive Strength Testing:
1. Test Method: Comply with ASTM C39.

2. Test Acceptance: According to ACI 318.
3. Test cylinders according to applicable codes.
4. Retain one cylinder for testing when requested by Architect/Engineer.
5. Dispose of remaining cylinders if testing is not required.

H. Core Compressive Strength Testing:
1. Sampling and Testing Procedures: Comply with ASTM C42.
2. Test Acceptance: According to applicable code.
3. Drill three cores for each failed strength test from failed concrete.

I. Water-Soluble Chloride Ion Concentration Test Method:
1. Comply with ASTM C1218.
2. Test at <_____> days.
3. Maximum Chloride Ion Concentration: As permitted by applicable code.

J. Patching:
1. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
2. Honeycombing or Embedded Debris in Concrete:
   a. Not acceptable.
   b. Notify Architect/Engineer upon discovery.
3. Patch imperfections as directed by Architect/Engineer.

K. Defective Concrete:
1. Description: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
2. Repair or replacement of defective concrete will be determined by Architect/Engineer.
3. Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION

SECTION 033005

CAST-IN-PLACE CONCRETE (RETAINING WALL)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes Cast-in-Place Concrete for Following Items:
1. Building frame members.
2. Beams, lintels, and columns.
3. Shear walls.
4. Elevator shaft walls.
5. Retaining walls.
6. Foundation walls.
7. Footings.
8. Supported slabs.
9. Slabs on grade.
10. Control, expansion, and contraction joint devices.
11. Equipment pads.
12. Light pole base.
13. Flagpole base.
14. Thrust blocks.
15. Manholes.

1.2 SUBMITTALS

A. Product Data: Submit data on joint devices, attachment accessories, and admixtures.

B. Design Data:
1. Submit concrete mix design for each concrete strength.
2. Submit separate mix designs if admixtures are required for following:
a. Hot and cold weather concrete Work.
b. Air entrained concrete Work.
3. Identify mix ingredients and proportions, including admixtures.
4. Identify chloride content of admixtures and whether or not chlorides were added during manufacture.

C. Samples: Two samples of expansion/contraction joints and control joints.

D. Manufacturer's Certificate: Products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit installation procedures and interfacing required with adjacent Work.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.

1.4 QUALITY ASSURANCE

A. Perform Work according to ACI 318.

B. Comply with ACI 305R when pouring concrete during hot weather.

C. Comply with ACI 306.1 when pouring concrete during cold weather.

D. Acquire cement and aggregate from one source for Work.

E. Fire-Rated Wall, Floor, and Roof Construction:
   1. Rating: As indicated.
   2. Tested Rating: Determined according to ASTM E119.

F. Perform Work according to applicable codes and construction documents.

1.5 AMBIENT CONDITIONS

A. Maintain concrete temperature after installation per applicable codes.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Vapor Retarder Permeance: Maximum 1 perms when tested according to ASTM E96.

2.2 MATERIALS

A. Concrete:
   1. Cement:
      a. Comply with ASTM C150 and construction documents.
      b. Type: Portland.
      c. Furnish materials according to applicable codes.
   2. Air Entrainment: Comply with ASTM C260.
   3. Chemical:
      a. Comply with ASTM C494.
   4. Fly Ash: Comply with ASTM C618.
   5. Silica Fume: Comply with ASTM C1240.
   6. Slag:
      a. Description: Ground-granulated blast-furnace slag.
      b. Comply with ASTM C989.
   7. Plasticizing:
      a. Comply with ASTM C1017.

2.3 CONCRETE MIX

A. Select proportions for concrete according to ACI 318 trial mixtures and field test data.

B. Performance and Design Criteria:

   1. Per construction documents and applicable codes.

C. Admixtures:

1. Include admixture types and quantities indicated in concrete mix designs only if approved by Architect/Engineer.
2. Cold Weather:
   a. Use accelerating admixtures in cold weather.
   b. Use of admixtures will not relax cold-weather placement requirements.
3. Hot Weather: Use set-retarding admixtures.
4. Do not use calcium chloride or admixtures containing calcium chloride.
5. Add air entrainment admixture to concrete mix for Work exposed to freezing and thawing or deicing chemicals.
6. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fumes, and slag content as required by applicable code.

D. Average Compressive Strength Reduction: Not permitted.

E. Ready-Mixed Concrete: Mix and deliver concrete according to ASTM C94.

F. Site-Mixed Concrete: Mix concrete according to ACI 318.

2.4 ACCESSORIES

A. Bonding Agent:
   a. Furnish materials according to industry standards.

B. Vapor Retarder:
   a. Furnish materials according to construction documents.
   2. Type: As recommended for below-grade application.
   3. Joint Tape: As recommended by manufacturer.

C. Non-shrink Grout:
   a. Furnish materials according to construction documents.
   2. Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.
   3. Comply with ASTM C1107.
   4. Minimum Compressive Strength: 5,000 psi in 28 days.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Previously Placed Concrete:
   1. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
   2. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

3.3 INSTALLATION

A. Placing Concrete:
   1. Place concrete according to ACI 318.
   2. Notify testing laboratory and Architect/Engineer minimum 24 hours prior to commencement of operations.
   3. Ensure that reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
   4. Install vapor retarder under interior slabs on grade according to ASTM E1643.
   5. Repairs:
      a. Repair vapor retarder damaged during placement of concrete reinforcement.
   6. Joint Filler:
      a. Place joint filler in floor slab pattern placement sequence; set top to required elevations; secure to resist movement by wet concrete.
   7. Joint Devices:
      a. Coordination: Install construction joint devices in coordination with floor slab pattern placement sequence; set top to required elevations; secure to resist movement by wet concrete.
      b. Install joint device anchors, maintaining correct position to allow joint cover to be flush with floor and wall finish.
      c. Install joint covers in one-piece length when adjacent construction activity is complete.
   8. Deposit concrete at final position, preventing segregation of mix.
   9. Place concrete in continuous operation for each panel or section as determined by predetermined joints.
   10. Consolidate concrete.
   11. Maintain records of concrete placement, including date, location, quantity, air temperature, and test samples taken.
   12. Place concrete continuously between predetermined expansion, control, and construction joints.
   13. Do not interrupt successive placement and do not permit cold joints to occur.
   14. Place floor slabs in indicated saw-cut pattern.
   15. Saw-Cut Joints:
      a. Saw-cut joints within 12 hours after placing.
      b. Cut into 1/4 depth of slab thickness.
   16. Screeding:
      a. Screed floors and slabs on grade level.

B. Separate Floor Toppings:
   1. Prior to placing floor topping, remove deleterious material, roughen substrate concrete surface, and broom and vacuum clean.
   2. Place required dividers edge strips reinforcement and other items to be cast in concrete.
   3. Apply bonding agent to substrate.
   4. Place concrete floor toppings to required lines and levels.

C. Concrete Finishing:
   1. Provide formed concrete surfaces to be left exposed per construction documents and specifications.
   2. Finish concrete floor surfaces according to ACI 318.

3. Wood float surfaces receiving quarry tile, ceramic tile, terrazzo, and with full-bed setting system.
4. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin-set quarry tile, and thin-set ceramic tile.
5. Steel trowel surfaces indicated to be exposed.
6. In areas with floor drains, maintain floor elevation at walls and pitch surfaces uniformly to drains as indicated.

D. Curing and Protection:
1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Protect concrete footings from freezing per ACI 318.
3. Maintain concrete with minimal moisture loss at relatively constant temperature for period as necessary for hydration of cement and hardening of concrete.
4. Cure concrete floor surfaces as specified in Section.

5. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for seven days.

6. Spray water over floor slab areas and maintain wetness for seven days.

3.4 FIELD QUALITY CONTROL

A. Inspection and Testing: Performed by Owner's testing laboratory according to ACI 318.

B. Provide unrestricted access to Work and cooperate with appointed testing and inspection firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.

D. Concrete Inspections:
1. Continuous Placement Inspection: Inspect for proper installation procedures.
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

E. Strength Test Samples:
1. Sampling Procedures: Comply with ASTM C172.
2. Sampling shall be performed per the construction documents.
3. Cylinder Molding and Curing Procedures:
   a. Comply with ASTM C31.
4. If volume of concrete for a class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches, or from every batch if less than five batches are used.
5. Make one additional cylinder during cold weather concreting and field cure.

F. Field Testing:
1. Slump Test Method: Comply with ASTM C143.
2. Air Content Test Method: Comply with ASTM C173.
3. Temperature Test Method: Comply with ASTM C1064.
4. Compressive Strength Concrete:
   a. Measure slump and temperature for each sample.
   b. Measure air content in air-entrained concrete for each sample.

G. Cylinder Compressive Strength Testing:
1. Test Method: Comply with ASTM C39.

2. Test Acceptance: According to ACI 318.
3. Test cylinders according to applicable codes.
4. Retain one cylinder for testing when requested by Architect/Engineer.
5. Dispose of remaining cylinders if testing is not required.

H. Core Compressive Strength Testing:
1. Sampling and Testing Procedures: Comply with ASTM C42.
2. Test Acceptance: According to applicable code.
3. Drill three cores for each failed strength test from failed concrete.

I. Water-Soluble Chloride Ion Concentration Test Method:
1. Comply with ASTM C1218.
2. Test at <_____> days.
3. Maximum Chloride Ion Concentration: As permitted by applicable code.

J. Patching:
1. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
2. Honeycombing or Embedded Debris in Concrete:
   a. Not acceptable.
   b. Notify Architect/Engineer upon discovery.
3. Patch imperfections as directed by Architect/Engineer.

K. Defective Concrete:
1. Description: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
2. Repair or replacement of defective concrete will be determined by Architect/Engineer.
3. Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION

SECTION 03 30 05.1
CAST-IN-PLACE SITE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes: Cast-in-place concrete which consists of furnishing all material, mixing and transporting equipment, and performing all labor for the proportioning, mixing, transporting, placing, consolidating, finishing and curing of concrete in the wall structure. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, pozzolan, admixtures, and water as hereinafter specified, which shall include but not limited to the following:

1. Sidewalks, curbs, driveways, and pavement
2. Drainage flumes and storm structures
3. Foundations for rockwalls and/or CMU site walls

B. Related Sections: Additional Sections of the Documents which are referenced in this Section include:

1. Architectural Site Detail Sheets
2. Civil Drawing Sheets
3. Retaining Wall Sheets

1.2 QUALITY ASSURANCE

A. Quality Control by OWNER

1. To demonstrate conformance with the specified requirements for cast-in-place concrete, the OWNER shall provide the services of an independent testing laboratory, which complies, with the requirements of ASTM E329. The testing laboratory shall sample and test concrete materials as specified in paragraphs “03 30 00-2.01, 2.02, and 3.12”. Costs of testing laboratory services shall be borne by the OWNER.

B. Basis For Quality

1. Cast-in-place concrete shall conform to the requirements of ACI 301, except as modified herein.

1.3 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

C. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
AASHTO T210	Aggregate Durability Index
ACI 211.1	Selecting Proportions for Normal, Heavy Weight and Mass Concrete

Reference	Title
ACI 214	Evaluation of Strength Test Results of Concrete
ACI 301	Structural Concrete for Buildings
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 347R	Concrete Formwork
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C40	Organic Impurities in Fine Aggregate for Concrete
ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94	Ready-Mixed Concrete
ASTM C117	Materials Finer Than 75-□m (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C142	Clay Lumps and Friable Particles in Aggregates
ASTM C143	Slump of Portland Cement Concrete
ASTM C150	Portland Cement
ASTM C157	Length Change of Hardened Cement Mortar and Concrete

ASTM C172	Sampling Freshly Mixed Concrete
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
STM C260	Air-Entraining Admixtures for Concrete

Reference	Title
ASTM C289	Potential Reactivity of Aggregates (Chemical Method)
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C595	Blended Hydraulic Cements
ASTM C618	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM D75	Sampling Aggregates
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E329	Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
CRD-C572	Corps of Engineers Specifications for Polyvinylchloride Waterstop

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Reports of concrete mix designs and rebar shall be provided.

B. Digital Submittals: Submit to the Architect, or applicable consultant, shop drawings, product data, and samples required by specification sections. Do not submit illegible fax copies nor carbon copies of shop drawings and product data.

1. Submit using the Contractor's web-based project management program. Prepare submittals as .pdf files, with a single file for each submittal, and upload to the Contractor's project management program. Enter required data in program to fully identify submittal in accordance with the required submittal numbering format.

C. Within 30 days of the contract date, CONTRACTOR shall prepare and submit with the Schedule of Values a comprehensive list of ship drawings, product data and samples. This list shall include projects which are proposed for substitution. Also include the estimated date of each submittal and anticipated date of submittal return. Allow the Architect reasonable time to review submittals.

1. The list shall be compliled and submitted using the "Submittal" feature in the Architect's project management program.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: Portland cement shall be ASTM C150, Type I, low alkali, containing less than 0.60 percent (0.60%) alkalis.

B. Aggregates

1. General

a. Except as modified herein, fine and coarse aggregates shall conform to ASTM C33. Fine and coarse aggregates shall be regarded as separate ingredients. Aggregates shall be non-reactive and shall be washed before use.

b. Tests for size and grading of fine and coarse aggregates shall be in accordance with ASTM C136. Combined aggregates shall be well and uniformly graded from coarse to fine sizes to produce a concrete that has optimum workability and consolidation characteristics. The final combined aggregate gradation shall be established during the design mix.

c. When sources of aggregates are changed, test reports shall be provided for the new material. The tests specified shall be performed prior to commencing concrete work.

2. Fine Aggregate

a. Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine. Gradation shall conform to ASTM C33. Fine aggregate shall not exceed 40 percent by weight of combined aggregate total, except for concrete with coarse aggregate of less than maximum size 1/2 inch.

b. Variations from the specified gradations in individual tests will be acceptable if the average of three consecutive tests is within the specified limits and the variation is within the permissible variation listed below:

U.S. Standard Sieve Size	Permissable Variation in individual tests, percent (%)
30 and coarser	2
50 and finer	0.5

c. Other tests shall be in accordance with the following specifications:

Test	Test Method	Requirements
Amount of Material	ASTM C117	3 Percent passing No. 200 sieve maximum by weight
Reactivity	ASTM C289	As specified in ASTM C33, Appendix
Sand Equivalent	ASTM D2419	Minimum 75

3. Coarse Aggregate

a. Coarse aggregate shall be hard, dense and durable gravel or crushed rock free from injurious amounts of soft and friable particles, alkali, and organic matter. Other

deleterious substances shall not exceed the limits listed in ASTM C33, Table 3. Gradation of each coarse aggregate size specified in paragraph 03300-2.02 A shall conform to ASTM C33, Table 2.

b. Before and during field trial mixes, the Contractor may make minor adjustments to the above gradation to produce the specified concrete.

c. During progress of the work, variations from the specified gradations will be acceptable in individual tests if the average of three consecutive tests is within the specified limits.

d. Other tests shall be in accordance with the following specifications:

Test	Test Method	Requirements
Durability Index	AASHTO T210	Minimum 75
Soundness	ASTM C88	10 percent maximum loss with sodium sulfate

Test	Test Method	Requirements
Amount of Material	ASTM C117	1.0 percent maximum passing No. 200 sieve by weight
Abrasion	ASTM C131	35 percent maximum loss after 500 revolutions in Los Angeles Machine
Clay Lumps and Friable Material	ASTM C142	4.5 percent maximum by weight
Reactivity	ASTM C289	As specified in ASTM C33, Appendix

C. Fly Ash

1. Fly Ash shall be Class F, fly ash, conforming to ASTM C618. Fly ash shall contain less than 1 percent by weight carbon and less than 3 percent by weight sulfur trioxide. Fly Ash supplied during the life of the project shall have been formed at the same single source.

2. . The Fly Ash color shall not substantially alter the resulting concrete from the normal gray color and appearance.

D. Admixtures

1. General: Shall be compatible with the concrete. Calcium chloride or admixtures containing calcium chloride are not acceptable. Admixtures shall be used in accordance with the manufacturer's recommendations and shall be added separately to the concrete mix.

2. Water Reducing Retarder: Shall be ASTM C494, Type D, and shall be Master Builders, Pozzolith 300 R; Sika Chemical Corp., Plastiment; or equal. The water reducing retarder shall reduce the water required at least 11 percent for a given concrete consistency and shall comply with the water/cement ratio standards of ACI 211.1.

3. Air entraining agent: Shall be Master Builders, MB-AE10; W. R. Grace and Co.; DaraVair; or equal. The air entraining agent added shall produce, in accordance with ASTM C260, an entrained air content specified in paragraph 03300-2.02 A for each class of concrete.

E. Water

1. Water for washing aggregate, for mixing and for curing shall be free from oil and deleterious amounts of acids, alkalis, and organic materials; shall not contain more than 1000 mg/l of chlorides as Cl, nor more than 1300 mg/l of sulfates as SO4; and shall not contain an amount of impurities that may cause a change of more than 25 percent in the setting time of the cement nor a reduction of more than 5 percent in the compressive strength of the concrete at 14 days when compared with the result obtained with distilled water. Additionally, water used for curing shall not contain an amount of impurities sufficient to discolor the concrete.

2.2 CONCRETE CHARACTERISTICS

A. Mix Proportioning

1. Concrete shall be normal weight concrete composed of specified cement, Fly ash, admixtures, aggregates and water proportioned and mixed to produce a workable, strong, dense, and impermeable concrete. Water/cement ratio is based on the combined contents of cement and fly ash in a given mix proportion. Concrete shall be provided in accordance with the following:

Concrete Class	ASTM Coarse Aggregate Size	Maximum Water / cement ratio	Min. Cement Sacks/cu yd. Concrete[e]	Fly Ash percent by weight of Portland Cement	Minimum percent air content	Water Reducing Retarder[d]	Minimum 28- day compressive strength[a], psi
A	1 1/2	42	4.75	20	3% - 6%	Yes	4000
B	1	45	5.00	20	3% - 6%	Yes	4000
C-1	3/4	43	5.00	20	3% - 6%	Yes	4000
C-2	1/2	43	5.50	20	3% - 6%	Yes	4000
D	1/2	43	6.00	20	3% - 6%	Yes	4000
E[b]	1	53	3.00	--	--	No	2000
F	--	--	--	--	--	No	500[c]

[a] Compressive strength shall be determined at the end of 28 days based on test cylinders made and tested in accordance with ASTM C39.

[b] Concrete encasement for electrical conduit shall contain 3 pounds of red oxide per sack of cement.

[c] Minimum 28-day compressive strength shall be 500 psi and maximum 28-day compressive strength shall be 1000 psi.

[d] Admixture type shall be appropriate for ambient temperatures at the time of concrete placement, j.e., ,may use water reducing retarder in hot weather.

[e] Minimum cement content is minimum cement content not including fly ash.

2. Concrete shall be provided by class for the corresponding use listed as follows:

Type of Use	Class of Concrete
Concrete greater than 24 inches thick	A
Concrete greater than 12 to 24 inches thick inclusive	B
Concrete greater than 8 to 12 inches thick inclusive	C-1
Concrete less than 8 thick and where spaces are restrictive by reinforcing steel	C-2
Topping Concrete	D
Pipe Bedding and Encasement, Electrical Conduit Encasement (duct banks), and concrete fill	E
Encasement of reinforcement extension for future construction	F

For the use listed, concrete slump, sampled in accordance with ASTM C172 and tested in accordance with ASTM C143, shall be as follows:

Type of Use	Working Limit, ± 1 inch	
	Minimum	Maximum
Mass concrete, foundation slabs greater than 24 inches thick, tunnel inverts and unformed slopes.	1	2
Floor slabs, beams, foundation slabs and footings 24 inches thick or less, pavement, sidewalks and curbs	2	3 1/2
Walls and columns	4	6
Walls and columns	--	4
Pipe bedding encasement, electrical conduit encasement	4	8
Concrete fill	3	4

B. Control Tests

1. Mix Design

   a. Before beginning concrete work, the Contractor shall determine the proper proportions of materials for each strength and class of concrete. The mix shall consist of specified cement, pozzolan, admixtures, aggregate and water. Methods for selecting and adjusting proportions of the ingredients shall be in accordance with ACI 211.1. The laboratory reports of each mix design shall state whether the items reported comply with the specifications and shall show (1) the expected strength, (2) corresponding slump, (3) expected drying shrinkage, (4) weights and test results of the ingredients, and (5) other physical properties necessary to check each mix design. Copies of the laboratory reports shall be submitted in accordance with paragraph 03300-1.03.

   b. Each mix design shall be checked in the laboratory by the preparation of two trial batches, one with minimum slump and one with maximum slump. For each batch, six standard test cylinders shall be cast and cured as specified for the field concrete. Three cylinders from each batch shall be tested at age 7 days, two at age 14 days, and one at age 28 days. Drying shrinkage shall be measured as specified in paragraph 03300-2.02 C.3.

2. Field Trial Mix

   a. After acceptance of laboratory mix design and (except as noted below) prior to concrete placement, the Contractor shall establish, based upon the accepted design mixes, field proportions for the classes of concrete required. Field trial concrete shall be manufactured using the equipment to be used for the work. Minor adjustments shall be made in the design mixes to provide a dense, homogeneous, durable concrete with good workability and finishing qualities. Six standard test cylinders shall be obtained from the field trial mixes for concrete Classes A, B and C and tested as specified for mix design test cylinders. Drying shrinkage shall be measured as specified in paragraph 03300-2.02 C.3. The Construction Manager shall be notified 1 week in advance of field trial mix work; field trial mix work shall be performed with representatives of the Construction Manager and the testing laboratory being present. Sampling and testing of concrete shall be done by the independent testing laboratory specified in paragraph 03300-1.02 A. Certified copies of the laboratory test results shall be submitted to the Construction Manager. The Contractor may, solely at his own risk, produce, sample, and test field trial mixes for submittal concurrent with the submittal of the mix design required in paragraph 03300-2.02 C.1.

   b. Concrete shall not be placed in the field prior to acceptance of the field trial mix.

3. Drying Shrinkage

   a. Drying shrinkage specimens shall be prepared from the same concrete used for preparing compression test cylinders for mix design and for field trial mix and are required only for Classes A, B and C concrete. From each mix, three specimens shall be prepared. The drying shrinkage specimens shall be 4 x 4 x 11-inch prisms with an effective gage length of 10 inches, prepared, cured, dried and measured in accordance with ASTM C157 and as modified herein. Specimens shall be removed from molds at an age of 23 ± 1 hour after batching and shall be placed immediately in water at 73 ± 3 degrees F. Expansion, expressed as a percentage of original length, shall be measured at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations. Specimens shall then be stored immediately in a humidity control room maintained at 73 ± 3 degrees F and 50 ± 4 percent relative humidity for the remainder of the test. Measurement, to determine the drying shrinkage, expressed as percentage of base length, shall be made and reported separately for 7, 14, 21 and 28 days of drying after 7 days of moist curing.

b. The average drying shrinkage of each group of the test specimens after 28 days of drying shall not exceed the following:

Specimen	Drying Shrinkage, percent
Mix Design	0.050
Field Trial	0.063

2.3 BONDING COMPOUNDS

Provide the following products or approved equal.

A. Polyvinyl acetate or Acrylic base

1. Polyvinyl Acetate (Interior Only):

a. “Euco Weld” ; Euclid Chemical Co.

b. “Thorobond” ; Thoro Div, Harris Specialty Chemicals, Inc.

2. Acrylic or Styrene Butadiene:

a. “J 40 Bonding Agent” ; Dayton Superior Corp.

b. “Sonocrete” ; Sonneborn Div, Chemrex Inc.

c. “Acrylic Bondcrete” ; The Burke Co.

d. “SBR Latex” ; Euclid Chemical Co.

e. “Acryl 60” ; Thoro Div., Harris Specialty Chemicals, Inc

B. Epoxy Adhesive:

1. Two component material conforming to ASTM C 881 suitable for use on dry or damp surfaces. Provide material AType@, AGrade@, and AClass@ to suit project requirements.

a. “Rezi-Weld” ; W.R.Meadows, Inc.

b. “Sikadur Hi Mod” ; Sika Chemical Corp.

c. “Euco Epoxy 452 or 620” ; Euclid Chemical Co.

d. “Burkepoxy” ; The Burke Co.

e. “J-50 Sure-Anchor Epoxy” ; Dayton Superior Corp.

f. “Thorobond Epoxy Liquid” ; Thoro Div., Harris Specialty Chemicals, Inc.

2. Bonding compounds shall be applied in accordance with the manufacturer's instructions.

2.4 RETARDANT

A. Retardant for exposing aggregates for nonformed surfaces in construction joints shall be Sika Rugasol- S, Horn Aggretex-H, Burke Company True Etch Surface Retarder, or equal. Retardant shall be applied in accordance with manufacturer's instructions sufficient to assure a minimum penetration of 1/8 inch.

2.5 SURFACE HARDENER

A. Surface hardener and dust proof products shall be premixed, non-colored nonmetallic Hardener by W.R Grace, Sonneborn, Dayton Superior, Burke Co.; or equal applied in strict compliance with manufacturer’s instructions. Must be compatible with air content of concrete.

2.6 CURING AND SEALING COMPOUNDS

A. Liquid type membrane -forming curing compound complying with ATSM C 309, Type I, Class A. moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./ gal. Provide the following products or approved equal.

1. “Kurez DR VOX ” ; Euclid Chemical Co.
2. “J 11-W Resin Cure ” ; Dayton Superior.
3. “Aqua Resin Cure ” ; The Burke Co.
4. “Kure N Seal ” ; Sonneborn Div., Chemrex, Inc.

2.7 EVAPORATIVE REDUCER

A. To prevent rapid drying, reduce surface evaporation, and aid in finishing. Acceptable products are Confilm by Master Builders or Sure Film by Dayton Superior; or equal.

2.8 MOISTURE-RETAINING SHEETS (POLYETHYLENE SHEETS)

A. Provide polyethylene sheeting conforming to ASTM C171 “Sheet Materials for Curing Concrete”. Polyethylene sheeting shall have a minimum thickness of 0.004 inch.

B. Other acceptable moisture retaining sheets include Waterproof paper and Polyethylene – coated burlap conforming to ASTM C171.

2.9 ABSORPTIVE COVER

A. Burlap cloth made from jute or kenaf, weighing approximately 9 oz. Per sq. yd., complying with AASHTO M182, Class 2.

2.10 WATER RESISTANT BARRIER PAPER

A. Water resistant barrier paper consisting of heavy Kraft papers laminated together with glass fiber reinforcement and over-coated with black polyethylene on each side.

2.11 NON-SHRINK GROUT

A. Provide the following products or approved equal. Factory pre-mixed non-metallic, grout, conforming to CRD-C 588:

1. "Set Grout" or “Construction Grout”; Master Builders Div., Chemrex,Inc.
2. "Sonogrout " or "Sonopatch " Sonneborn Div . ,Chemrex , Inc.
3. “1107 Advantage Grout,” Dayton Superior Corp.
4. "Sika Repair 223; Sika Corp.
5. "Five Star Structural Concrete” Five Star Products, Inc.

B. Factory Pre-mixed non-metallic, quick-set polymer-modified repair mortar conforming to ASTM C109, ASTM C190, and ASTM C348 such as “Water plug” by Thoro System Products, Inc. 7800 NW 38th St., Miami, Florida or equal.

2.12 FORMS

A. Forms shall conform to ACI 347 and shall be designed and constructed to provide the finish specified in paragraph “03 30 00-3.11 B”.

2.13 PRODUCT DATA

The following information shall be provided in accordance with Section 01300.

A. Manufacturer's Data:

1. Copies of manufacturer's data shall be provided for the following:

a. Retardants
b. Curing compounds
c. Bonding compounds
d. Surface hardener
e. Pozzolan
f. Evaporation reducer
g. Moisture – retaining sheets
h. Absorptive cover
i. Water – resistant barrier paper
j. Non-shrink or other grouts

B. Laboratory Test Reports:

1. Before delivery of materials, copies of the reports of the tests specified herein shall be provided. Test reports on previously tested materials shall be accompanied by the manufacturer's statement that the previously tested material is the same type, quality, manufacture and make as that proposed for use in this project. Test reports are required for the following:

a. Cement
b. Aggregates
c. Pozzolan
d. Admixtures
e. Curing compounds
f. Retardants
g. Bonding compounds
h. Concrete strength, slump, temperature, and air content
i. Final laboratory report.

C. Ready-Mixed Concrete Truck Delivery Tickets

1. Each load of ready-mixed concrete delivered to the job site shall be accompanied by a delivery ticket showing the information listed in ASTM C94, Section 16.

D. Evidence of Testing Laboratory Competence

1. The Contractor shall require that the laboratory provide directly to the Owner evidence of the most recent inspection of its facilities by the Cement and Concrete Reference Laboratory of the National Bureau of Standards. The evidence shall show that deficiencies mentioned in the report of that inspection have been corrected. The evidence of inspection shall be provided prior to beginning the work of this section.

PART 3 - EXECUTION

3.1 GENERAL

A. As provided in the General Conditions, the Owner is defining the quality of cast-in-place concrete by specifying in this part some of the means, methods, techniques, sequences and procedures for construction of cast-in-place concrete. The Contractor, without relinquishing authority and responsibility for supervision and direction of the work, agrees to follow the specified means, methods, techniques, sequences and procedures.

3.2 CONCRETE MIXING

A. Mixing Equipment: All mixing equipment shall meet the requirements of ASTM C94. Mixers may be stationary mixers or truck mixers. Agitators may be truck mixers or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place, a metal place or plates on which are plainly marked, for the various uses for which the equipment is designed, the capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum, blades, or paddles. Stationary mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed. Truck mixers shall be equipped with means by which the number of revolutions of the drum blades, or paddles may be readily verified.

1. When the concrete is truck mixed, the volume of the mixed concrete shall not exceed 65% of the total volume of the drum or container. When the concrete is central mixed, the volume of concrete in the truck mixer or agitator shall not exceed 85% of the total volume of the drum or container.

2. The mixer, when loaded to capacity, shall be capable of combining the ingredients of the concrete within the specified time into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity. No mixer or agitator shall be used if the results of slump tests of individual samples taken at approximately the one-quarter, and the three-quarter points of the load differ by more than 2 inches. Mixers and agitators shall be inspected frequently for changes in condition due to accumulations of hardened concrete or mortar, or to wear of blades. When the wear of the blades exceeds 10% of their original dimension (blade portion) the blades shall be replaced with new blades of the proper dimension. A copy of the design, i.e., the size, configuration, slope of the blades as produced by the manufacturer shall be submitted to the Engineer in order to establish the control size for the blades. When any such change of conditions if found, the slump test described above shall be repeated.

3. Truck mixers shall have adequate water supply and metering devices. No water shall be added to the concrete after the initial mixing water without the permission of the Engineer.

B. Mixing and Delivery: When a stationary mixer is used for the entire mixing of the concrete, the mixing time for one cubic yard of concrete shall be a minimum of 60 seconds, with an increased mixing time of 15 seconds for each additional cubic yard or portion thereof.

1. When a stationary mixer is used for partial mixing, the mixing time shall be a minimum of 30 seconds. Mixing shall be completed by truck mixer by mixing speed.

2. Mixing time shall be measured from the time all cement and aggregates are in the drum. The batch shall be so charged into the mixer than some water will enter in advance of cement and aggregate, and all water shall be in the drum by the end of the first one fourth of the specified mixing time.

3. Mixing at mixing speed shall begin immediately after all ingredients are in the mixer. For complete mixing in the truck, each batch shall be mixed not less than 70 or more than 100 revolutions of the drum. For partial mixing in the truck each batch shall be mixed not less than 50 no more than 100 revolutions of the drum. Mixing speed shall be as designated by the manufacturer. All revolutions after the prescribed mixing time shall be at agitating speed. The agitating speed shall be not less than one no more than four revolutions per minute. The drum shall be kept in continuous motion from the time mixing is started until the discharge is completed.

4. The maximum time interval between the introduction of the mixing water to the cement and aggregates, and the placing of the concrete in the forms shall not exceed the following:

Air of Concrete Temperature	
(Whichever is Higher)	**Maximum Time**
90°F or above (Air temperature Only)	45 minutes
75° to 89°F	60 minutes
35° to 74°F	90 minutes

5. Concrete not placed within the time specified above will be cause for rejection of that load, at the sole discretion of the Engineer, and at no cost to the Owner.
6. Concrete shall not be placed when the ambient temperature is less than 40 deg. F and falling but may be placed when the ambient temperature is 40 deg. F or higher or if the temperature is 35 deg. F and rising. Concrete shall not be placed when the temperature will drop below 35 deg. F within 24 hours after placement as projected by the National Weather Service unless properly protected. The temperature of the concrete at the time of placement in the forms shall be not less than 50 deg. F. Use of blankets, insulated boards, heaters, etc., shall be in accordance with the requirements of ACI 306.
7. Concrete shall not be placed when the ambient temperature is more than 100° F. Concrete temperature shall not exceed 90° F at the time of placement of concrete into the forms. Use ice or chilled water, or other methods as per ACI 605, as may be required to maintain concrete temperature below 90°F. Concrete placement, curing and protection in hot weather shall be in accordance with ACI 605.
8. The Contractor shall furnish to the Engineer with each batch of concrete before unloading at the site, two copies of a delivery ticket (may be computer generated) on which is printed, information concerning the concrete in the delivery truck as follows: It is intended that water not be added to the concrete mix. Water shall not be added to the concrete mix, unless authorized in writing by the Contractor's Superintendent and approved by the Engineer.
   a. IDENTIFICATION OF ON-SITE BATCH PLANT:
   b. SERIAL NUMBER OF TICKET:
   c. DATE:
   d. TRUCK NUMBER:
   e. SPECIFIC DESIGNATION OF JOB (Name & Location):
   f. SPECIFIC CLASS OR DESIGNATION OF THE CONCRETE:
   g. AMOUNT OF CONCRETE IN CUBIC YARDS:
   h. TIME LOADED OR OF FIRST MIXING OF CEMENT AND AGGREGATES:
   i. WATER ADDED BY RECEIVER OF CONCRETE (CONTRACTOR'S FIELD SUPERINTENDENT) AND HIS INITIALS:
   j. READING OF REVOLUTION OF COUNTER AT FIRST ADDITION OF WATER OR AT START OF MIXING IF PREMIXED:
   k. TYPE, BRAND AND AMOUNT OF CEMENT:
   l. MAXIMUM AGGREGATE SIZE:

m. WEIGHTS OF FINE AND COARSE AGGREGATE:

The two (2) copies of the delivery tickets shall be delivered to the Engineer at the end of each day placement.

9. The addition of High Range Water Reducer (Superplasticizer) to the mix shall be allowed only at the job site, just prior to placement. High Range Water Reducer (Superplasticizer) shall be added in the presence of the Engineer or his representative.

3.3 CONVEYING AND PLACING CONCRETE

1. Conveying Concrete: Concrete shall be handled from the mixer to the place of final deposit in a manner which will prevent segregation and when practicable, shall be deposited in its final position without re handling or flowing. All equipment used in transporting the concrete shall be maintained in a clean condition. Concrete shall not be delivered from hoists by spout or trough, nor dumped into carts, with a free fall of more than 4 feet. Every precaution shall be taken to prevent separation or loss of ingredients while transporting the concrete. Runways for carts or buggies shall not bear upon the reinforcing or fresh concrete. Pumping and conveying of concrete shall be done only after approval by the Engineer and with equipment which will insure a continuous flow without segregation.

2. Placing: Concrete shall not be placed until all reinforcement is securely and properly fastened in its correct position. Form ties shall be checked and retightened where necessary. Forms and reinforcement shall be inspected and approved by the Engineer prior to closing and again before beginning placement of concrete. All embedded items shall be in place and anchored and the forms and reinforcement shall be cleaned and cleanout openings closed before such inspection. A procedure for inspection of forms, reinforcing, inserts, etc., prior to all concrete placement will be instituted and coordinated with the Engineer. At least twenty-four hours prior to concrete placement, the Contractor shall submit an inspection sheet to the Engineer. The inspection sheet, to be developed, shall show the location and quantity of concrete to be placed, the time and date scheduled for placement and shall be signed by the Contractor's previously designated, representative. Signing of the sheet shall certify that all of the items necessary have been inspected, and that the area is ready for final review by the Engineer. The placement location shall be reviewed by the Engineer, who shall return a copy of the inspection sheet marked "no exceptions taken"; "make corrections noted"; listing the deficiencies; or "not approved for concrete placement", if the placement area has not been properly prepared and/or a significant delay would occur due to the time required to make extensive corrections of the listed deficiencies. If the Engineer determines that the corrections are excessive and will require and extensive amount of time, the placement shall be rescheduled, and the Engineer shall be notified 12 hours before scheduled placement, after the corrections are made. A representative of the Engineer will be on the job during placement of concrete and concrete shall not be placed unless the Engineer or his representative is present.

3. Concrete shall be placed in a manner which will prevent segregation, thoroughly embed all reinforcement and fixtures, fill all angles in the forms and prevent formation of aggregate pockets or honeycomb. Placement in walls, columns or other deep forms shall be done through openings in the forms, spaced at frequent intervals, or through tremies so that the free fall shall not exceed 4 feet. Points of depositing the concrete shall be spaced so that the concrete surfaces can be kept level without using vibrators or other equipment to cause it to flow into place. See paragraph "3.11 MONOLITHIC SLAB FINISHES" for slab construction requirements.

4. Concrete shall be placed with the aid of approved mechanical vibrating equipment. Vibration shall be applied to the concrete and shall be of sufficient intensity and duration to cause flow or settlement of the concrete, thorough compacting, and complete

embedment of reinforcement and fixtures. Supplemental forking and spading by hand may be required to secure dense uniform surfaces and complete filling of corners and angles. Vibration of concrete is to properly consolidate the concrete and shall not be used to move concrete horizontally. Concrete shall be consolidated in accordance with ACI 301, Chapter 8. Concrete placement shall be suspended if proper consolidation is not being addressed until proper consolidation is instituted.

5. Excessive spading or vibrating causing undue water gain or segregation will not be permitted. If moderate working causes excessive water gain the mix shall be adjusted. Excess water shall be removed when it appears. When concrete in floors or slabs is deposited on the ground, the sub grade shall be thoroughly compacted and moistened before concrete is placed. Concrete shall not be placed in forms until they have been thoroughly moistened and reinforced steel has been cooled. A grill tamp shall be used on floor slabs. Completed sections shall conform to the details on the Contract Drawings and the concrete shall be dense, uniform and free of aggregate pockets or honeycomb.

6. Concrete in vertical walls shall be placed in continuous horizontal layers approximately 18 inches in depth. Not more than one hour shall elapse between the placing of successive layers of concrete in any portion of a structure included in a continuous placement.

7. Concrete shall generally not be placed during high winds with blowing dust that will contaminate the surface and cause entrapment of sand and dust particles in the finished surfaces, and that will cause excessive moisture loss in the concrete.

3.4 FORMWORK

A. Formwork shall conform to ACI 347. All forms shall be sealed and shall be sufficiently tight to prevent loss of mortar from the concrete. The Contractor shall design and construct all formwork systems to provide only those lines and delineations indicated, unless otherwise approved by the Engineer. Formwork shall be constructed to allow erection in proper sequence and to permit removal without damage to the finished concrete surfaces.

B. The Contractor shall design, construct, and erect all forms for reuse; withdraw projecting nails or other objects from contact surfaces before reusing; clean and completely recondition all forms prior to reuse; and repair any damage to forming surfaces caused during previous usage. Approval of the Engineer shall be required for each reuse. Formwork with patches or repairs affecting appearance of the concrete surfaces will not be permitted. The Contractor is responsible for the strength and suitability of the formwork.

C. Unless otherwise specified, exposed edges of concrete on the outside of structures and all those in the inside of structures shall be chamfered or beveled at an angle of 45 degrees by using a PVC chamfer strip with nailing leg, such bevel being 3/4-inch on a side. If so directed by the Engineer, however, the Contractor shall provide square edges for any portion of the work. Tape and seal all reveal strips to prevent leakage and leave a perfectly smooth finish.

D. Snap tie type form ties approved by the Engineer shall be adjustable in length and of such type as to leave no metal within 1 inch of the surface, and shall not be fitted with lugs, cones, washers or other devices acting as a spreader which will leave a hole larger than 7/8-inch in diameter or a depression back of the exposed surface of the concrete. The tie section remaining within the concrete shall be manufactured with a water stop device. Wire used as ties will not be permitted.

E. Gang form through – wall ties shall be “she” bolt ties which leave a threaded comp ling in the wall. The threaded comp ling shall also be provided with a neoprene water stop washer.

3.5 CURING, PROTECTION AND SEALING

A. General

1. The purpose of curing procedures is to provide the most favorable conditions practicable

for development of the strength of the concrete without the formation of cracks or other defects. Such favorable conditions include the maintenance of proper moisture conditions and protection from large changes in temperature. The procedures specified herein are designed to maintain these favorable conditions and will be strictly enforced to this end. The Contractor shall repair all cracks, joints, or other defects in the concrete subject to the approval of the Engineer.

2. Use of proposed curing methods or specified systems shall be submitted in writing and will be subject to the approval of the Engineer. No curing method shall be used until approved by the Engineer for that type of structure. Submittal of curing methods or procedures shall not relieve the Contractor from providing concrete in place which has been properly cured and meets the requirements of specifications.

3. The Contractor shall inform the Engineer fully as to the methods and procedures proposed for curing and have approval of the methods, equipment, and materials prior to placing concrete. The Contractor shall have, at the site of the wok, the proper equipment and material in adequate amounts to cure the concrete properly, prior to being given permission to place concrete.

4. Poor curing facilities or lack of attention to the proper curing of concrete shall be cause for the Engineer to stop all concrete construction on the job until proper curing is provided.

5. The curing period for all concrete begins immediately after placing and/or finishing operations are completed. Delay in initiation of curing measures shall not be tolerated. All concrete shall be kept wet and shall be protected from large changes in temperatures, for a period of seven (7) days after placement. Curing measures shall consist of the following, unless similar measures are demonstrated to achieve the same or better results are approved by the Engineer in writing.

6. Concrete surface temperature shall be maintained between 50 degrees F and 80 degrees F for at least 5 days. Curing concrete in hot weather (above 85 degrees F) shall be in accordance with ACI 305 R. Curing concrete in cold weather (below 45 degrees F) shall be in accordance with ACI 306 F.

7. When water curing is used, concrete shall be kept wet continuously for a minimum of 7 days after placement. Absorptive mats or fabric may be used to retain moisture during the curing period.

8. Unless otherwise specified, water curing shall be used for all structures. Forms shall be covered and kept moist. The forms shall be loosened, as soon as possible without damage to the concrete, and provisions made for curing water to run down inside them. During form removal, care shall be taken to provide wet cover to newly exposed surfaces. At the end of the specified curing period, the covering shall be left in place without wetting for several days.

B. Slabs

1. Slabs On Grade

a. Slabs on grade that are not in contact with water may be water cured per paragraph (1) above or by one of the following methods:

b. Wet curing with mats as specified or with burlap covered with polyethylene sheeting. Mats shall be kept continuously wet for the entire period. Polyethylene sheeting shall be at least 0.004-inch-thick and shall be subject to approval by the Engineer. Polyethylene sheeting over the burlap shall be so applied that all joints and laps are sealed so that the moisture will be retained over the area of the concrete. Slabs shall be thoroughly wetted immediately prior to placement of the polyethylene sheeting

and burlap. Whatever covering is used shall remain in place until its removal is required by some succeeding construction operation, but in any case, shall remain in place not less than seven (7) days.

c. Membrane curing compound may be used as specified and shall be applied in two different directions, perpendicular to each other. After applying the curing compound, the slab shall be covered with mats or burlap covered with polyethylene sheeting as in (2)(a) above to protect the surface. This protection shall be maintained for a minimum of seven (7) days.

C. Curing Compound

1. When curing compound is used, it shall be applied as soon as the concrete has set sufficiently so as not to be marred by the application or immediately following form removal for vertical and other formed surfaces. Preparation of surfaces, quantities used, application procedures, and installation precautions shall be followed in strict compliance with the manufacturer's instructions and these specifications.

2. Membrane curing compound shall utilize pigmented type compound conforming to Corps of Engineers Specifications CRD-C 300. Membrane shall be applied so that a continuous adherent film is formed with coverage of not more than 180 square feet per gallon.

3. Curing compound shall not be used on concrete surfaces to be coated, waterproofed, moisture proofed, tiled, roofed, or where other coverings are to be bonded, unless the curing compound is compatible with the final finish covering or it is removed prior to covering.

D. Protection

1. Concrete shall be protected against all adverse conditions, including weather, and against mechanical damage, until completion of the project. Concrete undergoing water curing shall not be allowed to dry out from the time it is placed until the expiration of curing period. Any such damage incurred shall be promptly repaired by the Contractor at his own expense, in a manner approved by the Engineer.

2. Concrete shall be protected against low and high temperatures in accordance with ACI 306 and 305 and by maintaining a placement temperature not less than 50 degrees F and by maintaining a temperature of not less that 50 degrees F for five (5) days after placement. Concrete shall also be protected against extremes of high temperature, low humidity and wind movement, by means of the curing methods specified herein or other methods approved by the Engineer. It shall be the responsibility of the Contractor to anticipate, as nearly as possible, changes in weather conditions such as sudden changes in temperature or high winds, which would affect the placement and protection of the concrete. The Contractor shall be prepared at all times with proper materials, equipment and personnel, to protect freshly placed concrete when sudden changes in the weather make such protection necessary. Failure to have available proper materials, equipment, or personnel for expeditious placement and adequate protection of the concrete will be grounds for postponement of placing of concrete. Arrangements for covering, insulating, and protecting concrete in cold weather shall be in accordance with ACI 306 R.

3. Concrete shall be protected from injurious action by sun, rain, flowing water, frost and mechanical injury, and shall not be allowed to dry out from the time it is placed until the expiration of curing periods.

4. Steel troweled slabs shall be protected with kraft paper, 6 mil. thick polyethylene membrane, or other similar waterproof material for at least 2 weeks after placement. Joints between adjacent strips of the paper shall be sealed. Float or broom finished slabs need to be protected after curing only in areas subject to damage during

construction.

5. Arrangements for covering, insulating, and protecting concrete in cold weather shall be in accordance with ACI 306 R.

3.6 CONSTRUCTION JOINTS

A. General

1. Concrete in each unit of construction shall be placed continuously. Before new concrete is placed on or against concrete, which has set, forms shall be retightened, and the surface of the set concrete shall be cleaned of foreign matter.

B. Construction

1. Construction joints shall be formed as specified. A rough surface of exposed concrete aggregates shall be produced using a surface retardant at construction joints, including joints between slabs and topping concrete. The limit of the treated surfaces shall be 1 inch away from the joint edges. Within 24 hours after placing, retarded surface mortar shall be removed either by high pressure water jetting or stiff brushing or combination of both so as to expose coarse aggregates. A rough surface of exposed aggregate may also be produced by sandblasting followed by high pressure water jetting. Sandblasting, if used, shall remove 1/8 inch of laitance film and shall expose coarse aggregate to insure adequate bond and water tightness at the construction joints.

2. Before concreting operations are resumed at construction joints, the surface of the concrete shall be thoroughly cleaned, saturated, then slushed with a coating of neat cement grout against which the fresh concretes shall be placed before the grout has attained initial set. Care shall be taken to ensure that the first layer of new concrete contains sufficient mortar for adequate bond.

C. Locations - Construction joint locations shall be as follows:

1. Unless otherwise noted for special placement configuration on the Drawings, such as round slabs, slabs shall be cast in panels not to exceed 40 feet in length or not to exceed 1600 square feet in area. Panels shall be cast in checkerboard patterns. Minimum lapsed time between placing adjacent panels shall be 24 hours.

3.7 INSERTS AND EMBEDMENTS

A. Inserts

1. Where pipes, castings or conduits are to pass through structures, the Contractor shall place such pipes or castings in the forms before placing the concrete, or he may provide openings in the concrete for subsequent insertion of such pipes, castings or conduits. Such openings shall be provided with water-stops and V shaped construction joint as shown and shall have a slight flare to facilitate grouting and permit the escape of entrained air during grouting. Horizontal conduits, where shown in structural slabs and beams, shall be placed between the top and bottom layers of reinforcement.

2. Additional reinforcement shall be provided around large openings as shown. The grout shall be non-shrink grout as specified herein.

B. Embedments

1. Gate frames, gate thimbles, special castings, channels or other miscellaneous metal parts that are to be embedded in the concrete shall be set and secured in the forms prior to concrete placement. Unless otherwise specified, anchor bolts and inserts shall be embedded in concrete as shown. The Contractor shall provide inserts, anchors or other bolts necessary for the attachment of piping, valves, metal parts and equipment. Nailing blocks, plugs, strips, and the like necessary for the attachment of trim, finish and similar work shall be provided. Voids in sleeves, inserts and anchor slots shall be filled

temporarily with readily removable material to prevent the entry of concrete into the voids. Operators or sleeves for gate or valve stems shall be positioned to clear reinforcing steel, conduit and other embedment, and to align accurately with equipment. All exposed embedded items shall have a tooled edge all around unless otherwise noted. Embeds, openings, etc., will also have tooled connecting joints in a pattern acceptable to the Engineer.

3.8 EXPANSION JOINTS

A. Expansion joints shall be as shown. Reinforcement or other embedded metal items bonded to the concrete shall not extend through expansion joints.

3.9 MODIFICATION OF EXISTING CONCRETE

A. Existing concrete shall be removed, and the remaining surfaces resurfaced as specified. The remaining concrete shall be protected from damage. Where possible, clean lines shall be made by sawing through the existing concrete. The concrete may be broken out after initial saw cuts in the event thickness prevents cutting through. Where it is not possible to use a saw, the initial cuts shall be made with chipping hammers. These cuts shall be sufficient to prevent damage to the remaining concrete. In general, an opening in existing concrete shall be oversized 1 inch on all sides and built back to the correct dimension with an epoxy grout. Where oversized openings cannot be made, the concrete shall be cut to the correct dimension, with the exposed reinforcing cut back an additional 1-inch and the resulting hole filled with epoxy grout. Cut or broken concrete surfaces shall be resurfaced with an epoxy grout. Concrete surfaces to be coated shall be dry. Where new concrete adjoins existing concrete surfaces or surfaces which have been cut, such surfaces shall be cleaned by sandblasting to remove laitance, loose coatings and foreign materials, and coated with the bonding compound just prior to the placement of the new concrete. Bonding compounds shall be as specified in paragraph 03300-2.04. Unless otherwise specified, continuity of reinforcing steel shall be obtained across the joint either by exposing existing bars to provide sufficient laps with new bars or by welding existing bars with new bars. Where shown, dowels shall be drilled and set with epoxy grout into existing concrete.

3.10 FORMED SURFACE FINISHES

A. Repair of Surface Defects

1. Concrete work obviously out of horizontal or vertical alignment or which shows serious surface defects shall be removed and replaced by the Contractor at his expense. In no case will patching be started until the areas to be patched are reviewed and accepted for patching by the Engineer. Patching of minor defects will be permitted provided such patching removes the defect. Immediately after removing forms the concrete shall be inspected for defects. All cracks, defects, or other deficiencies permitted by the Engineer to be patched or repaired, and where possible, form tie holes shall be patched before concrete is thoroughly dry. Defective areas shall be stripped away to a depth of not less than one inch with edges perpendicular to the surface. Areas to be repaired shall be cleaned, sand blasted, etc., to provide a roughened profile with all loose and/or deteriorated concrete removed so as to assure a good bond. Pre-wet surfaces as required prior to application of repair material and cure as required. All repair procedures and completed repairs shall be subject to the approval of the Engineer. Undercut or low areas shall be prepared and patched similar to defective areas subject to the approval of the Engineer. This and the surrounding area shall be wetted to prevent absorption of water from the patching mortar.

2. The patching mortar shall be an approved non-shrink, non-metallic, high strength grout of a minimum strength as used for the concrete with the coarse aggregate omitted and the amount of water used shall be as recommended by the approved grout manufacturer, as is consistent for proper handling and placing. The mortar shall be

thoroughly compacted into place, screeded off slightly higher than the surrounding surface and left undisturbed for a period of one or two hours. Final finishing shall conform to the finish of the surrounding areas subject to the approval of the Engineer.

3. Form tie holes of non-bearing water structures shall be patched with this same mortar, the holes being completely filled and the mortar tightly packed into the hole. Mortar shall be struck off flush with burlap or canvas and the patch finally finished to conform to the surrounding surface.

4. Should structural repair require epoxy injection of cracks, the following criteria shall govern.

   a. Epoxy used for crack injection process shall be a low viscosity epoxy material designed for pressure injection applications for crack repair in existing concrete. The system shall be capable of bonding to damp surfaces.

   b. Epoxy injection material shall be NSF approved for potable water containers, where applied under submerged conditions.

   c. Injection Resin must be one hundred percent solids material which cures with a minimum of shrinkage. It must have adequate wetting properties such that when applied to concrete, it must be capable of displacing water to provide adhesion to set concrete, and the capability of curing at sub-freezing temperatures.

   d. All epoxy injection shall be in accordance with the requirements of ACI 503.

5. Form tie holes of all water bearing structures shall be patched with a “water plug” type grout, i.e., “Water-plug” by the Thoro System Products, Inc. 7800 N.W. 38th Street, Miami, Florida 33166, subject to the approval of the Engineer. Prior to patching, the hole shall be thoroughly routed with a wire brush attached to a drill bit or other mechanical means, to insure removal of grease or other foreign material, then coated with an approved bonding agent. Mortar shall be struck off flush with burlap or canvas and the patch finally finished to conform to the surrounding surface. The Contractor remains responsible to ensure that all water bearing structures remain water-tight.

6. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

7. Repair finish unformed surfaces that contain defects which affect durability of concrete. Such surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop- outs, honeycomb, rock pockets, and other objectionable conditions.

8. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

9. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

B. Formed Surface Finishing

1. Formed surfaces shall be finished as soon as practicable after form removal and repair of surface defects. Finishes shall be as follows.

   a. Exposed Vertical Formed Surface – Exposed vertical formed surfaces include all exterior walls exposed to view, from top of wall to six inches below finished grade, the

top of the wall, and
from the top of the wall on the inside of the wall to 12” below the maximum water level and overhanging surfaces contiguous with the vertical wall surface.

b. Exposed formed surface shall have all tie rod holes filled, fins and rough edges removed, and all defects removed or patched. These surfaces shall receive two coats of cementitious coating as specified, subject to the approval to the Engineer. Coating for exterior surface of the exposed formed surfaces shall be a Cementitious Coating System composed of the
materials as specified under “Products”, for Cementitious Coating System. Where the concrete surface produced after placing concrete is not dense and smooth, and/or is not to the satisfaction of the Engineer, these surfaces shall receive the “Smooth Rubbed Finish” as specified below before application of the Cementitious Coating System. The final concrete surface shall be free of efflorescence, dirt, oil, unpainted form treatment, and other foreign substances which may require brush-off sand blasting. All surfaces must be thoroughly cured. Prior to applying the Cementitious Coating System, surface shall be repaired as required on exposed concrete surfaces, for inspection by the Engineer, to establish the smooth finish texture which will be required on the exposed surfaces to receive the cementitious coating.

(i) The application of the Cementitious Coating System shall consist of a minimum of two coats of coating material provide a coating of uniform appearance with a total minimum

DFT of 10 mils. The spraying apparatus used to apply the material shall be the type of manual sprayer typically used for spraying form coating and curing compounds. Care shall be taken to protect surface from over-spraying.

(ii) Prior to applying the two coats of the Cementitious Coating System, the surface to be sprayed shall be pre-wetted with potable water and bonding agent in the proportions of five gallons of potable water to 1 pint of acrylic bonding agent. The pre-wetted surface shall be at a surface saturated dry (SSD) condition with the water/acrylic bonding agent, when sprayed with the first coat of Cementitious Coating System.

2. Other Exposed, Formed Surfaces - For the purpose of this specification, other exposed, formed surfaces are defined as follows:

a. Entire inside and outside surfaces of all troughs and channels except inside surfaces of channels which are to be covered with concrete slabs, surfaces covered by grating but which are still visible, and outside surfaces not normally exposed will not require finishing;

b. All other exposed to view portions of water bearing structures contained wholly within the structure but not part of, or continuous with the exterior exposed to view walls;

c. Sides of beams, underside of cast-in-place beams, and slabs, and concrete stairs.

d. Other Exposed Formed Surfaces shall have all tie rod holes filled, fins and rough edges removed, and all defects removed or patched. These surfaces shall receive a “smooth rubbed finish”. “Smooth rubbed finish” shall be produced on freshly hardened concrete. All necessary patching shall have been completed not later than the following day. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until a uniform color and texture are produced. No cement paste shall be used other than the paste drawn from the green concrete itself by the rubbing process. Exposed cast-in-place surface of structures or pits within the buildings shall then receive the finish as specified in Division 9.

3. Unexposed Vertical Surfaces - For the purpose of this specification unexposed vertical surfaces are defined as follows:
   a. Those covered by earth fill six inches below the line of finished grade;
   b. Inside of all water-containing structures not otherwise scheduled; and
   c. Inside wall surfaces of miscellaneous boxes covered by a roof slab or by checker plate.
4. Unexposed vertical surfaces shall have all tie rod holes filled, fins, and rough edges removed, and all defects removed or patched.

3.11 MONOLITHIC SLAB FINISHES

A. Floor and Monolithic Slab Finishes - The finishes specified herein include surface finishes, treatments and toppings for floors and slabs. Special care shall be used in finishing floor surfaces to obtain true plane surfaces with no pockets or depressions except at floor drains. Where floor drains are shown, the floor shall be carefully graded to slope to the drain. Any such area which does not drain properly shall be corrected by removal and replacement of the concrete. Floors shall be sloped to drain uniformly as described above. Unless otherwise noted, slope top and bottom of slab to maintain constant thickness throughout. Where finish is not specified, floor slabs shall receive steel troweling. Dry cement shall not be used on new concrete surfaces to absorb excess moisture. Edges shall be rounded to a radius of 1/2 inch. Joints shall be grooved to a radius and depth of 1/4 inch each. Rigid screed guides shall be used during placement of all slabs. “Wet” screeds are not acceptable.

B. After placing slabs, plane surface to tolerances for floor flatness (FF) of 20 and floor levelness (FL) of
17. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes. Those areas to receive concrete topping shall be left with an exposed aggregate surface.

C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand bed terrazzo, and as otherwise indicated.
After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power driven floats, or both. Consolidate surface with power driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of FF 22 FL 18. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

D. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand- troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of FF 25 - FL 20.

E. Non-Slip Broom Finish – Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
Immediately after float finishing and one troweling pass, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with the Engineer before application.

F. Building Floors - The building floors shall be finished by carefully grading and sloping the slabs to the point of drainage, as shown on the plans, and then floating and troweling as described above, except as otherwise specified. Screeds shall be set as required using screed guides to ensure that true surfaces, accurate to grade, are secured. “Wet” screeds will

not be allowed. Floors shall be thoroughly troweled to produce a hard-smooth finish which rings when struck with the trowel. Machine troweling will be permitted, but the final troweling shall be by hand. Platform and dock slabs, stairs and walks shall be troweled, after floating, and then lightly brushed to provide a “non-skid” surface. Floor slabs shall be placed to a tolerance of FF 25 - FL 20. All concrete floors in the building shall be treated with a liquid hardener and dust-proofer, applied in strict accordance with the manufacturer’s instructions. Immediately prior to final completion of the projects, all such floors shall be also treated with one coat of hardener/dust-proofing, to harden seal and dust-proof the floors.

3.12 FIELD SAMPLING AND TESTS

A. General

1. Field sampling and testing shall be performed by the independent testing laboratory specified in paragraph 03300-1.01 A. Samples of aggregates and concrete shall be taken at random locations and at such times to represent the quality of the materials and work throughout the project. The laboratory shall provide the necessary labor, materials and facilities for sampling the aggregate and for casting, handling and storing the concrete samples at the site of work. Aggregates shall be sampled in accordance with paragraph 03300-3.14 B not less than 30 days prior to the use of such aggregates in the work. The minimum number of samples and tests are specified in paragraph 03300-3.14 C.

B. Sampling

1. Aggregates

a. General: Fine and coarse aggregates shall be sampled in accordance with ASTM D75. Samples shall be taken at the discharge gates of the bins feeding the weigh hopper. The Contractor shall provide safe and suitable facilities for obtaining samples. Samples shall be obtained at the concrete batch plant at the frequency specified in paragraph 03300-3.16 C. Sampling shall be repeated when the source of material is changed or when unacceptable deficiencies or variations from the specified requirements of materials are found in testing. Aggregate samples shall be tagged and their sources identified.

b. Coarse Aggregate: A sample weighing between 50 and 60 pounds shall be taken after the batch plant is brought up to full operation. The samples shall be taken so that a uniform cross section, accurately representing the materials on the belt or in the bins, is obtained.

c. Fine Aggregate: Samples shall be taken as specified for coarse aggregate. The samples shall be taken for sieve analysis of fine aggregate and specific gravity tests. Samples of sand shall be taken when the sand is moist.

2. Concrete

a. Samples of plastic concrete shall be obtained in accordance with ASTM C172. Samples for pumped concrete shall be taken at the hose discharge point. Samples for other concrete shall be taken at the hopper of concreting equipment or transit mix truck.

C. Testing

1. Aggregate

a. A minimum of one test of coarse aggregate per 400 cubic yards of concrete and a minimum of one test of fine aggregate per 200 cubic yards of concrete used shall be made to confirm continuing conformance with specifications for gradation, cleanliness and sand equivalent. A maximum of one test per day of each aggregate

is required. The full test program is required before source changes will be accepted.

2. Concrete

a. Strength tests

(i) The strengths specified for the design mix shall be verified by the testing laboratory during placement of the concrete. Verification shall be accomplished by testing standard cylinders of concrete samples taken at the job site.

(ii) Standard cylinders shall represent the concrete placed in the forms. One set of four standard cylinders shall be cast of each class of concrete for each 100 cubic yards or less or for each 4000 square feet of surface area poured per day. A fifth cylinder shall be cast for every three sets of four cylinders. Casting, handling and curing of cylinders shall be in accordance with ASTM C31. Additional cylinders shall be provided when an error in batching is suspected. For the first 24 hours after casting, the cylinders shall be kept moist in a storage box constructed and located so that its interior air temperature will be between 60 and 80 degrees F. At the end of 24 hours, the cylinders shall be transported to the testing laboratory.

(iii) Testing of specimens for compressive strength shall be in accordance with ASTM C39. Tests shall be made at 7 and 28 days from time of casting. Two test cylinders from each group of four shall be tested at the end of 7 days and two shall be tested at the end of 28 days. The fifth cylinder shall be tested at the end of 90 days only. A strength test shall consist of the average strength of two cylinders cast from material taken from a single load of concrete.

(iv) Each strength test result shall be the average of the strengths of two test cylinders at 28 days, except that if one cylinder in a set of two shows evidence of low strength due to improper sampling, casting, handling or curing, the result of the remaining one cylinder shall be used.

(v) The average of any three consecutive 28-day strength test results of the cylinders representing each class of concrete for each structure shall be equal to or greater than the specified strength and not more than 10 percent of the strength test results shall have values less than the specified 28-day strength for the total job concrete. No individual strength test results shall be less than the specified strength by more than 500 pounds per square inch.

(vi) Certified reports of the test results shall be provided directly to the Engineer. Test reports shall include sufficient information to identify the mix used, the stationing or location of the concrete placement, and the quantity placed. Slump, air content, temperature of concrete, and ambient temperature shall be noted. The 28-day strength test results shall be evaluated in accordance with ACI 214. Quality control charts showing field test results shall be included with the test results for each class of concrete in each major structure. Charts shall be prepared in accordance with ACI 214. Quality control charts shall be maintained throughout the entire job and shall be available for the Engineer's inspection at any time.

(vii) If the 28-day test results fall below the specified compressive strength for the class of concrete required for any portion of the work, adjustment in the proportions, water content, or both, shall be made as necessary at the Contractor's expense. Changes and adjustments shall be reported in writing to the Engineer.

(viii) If compressive test results indicate concrete in place may not meet structural

requirements, tests shall be made to determine if the structure or portion thereof is structurally sound. Tests may include, but not be limited to, cores in accordance with ASTM C42 and any other analyses or load tests acceptable to the Engineer. Costs of such tests shall be borne by the Contractor.

b. Tests for consistency of concrete

(i) The slump shall be as specified when measured in accordance with ASTM C143. Samples for slump determination shall be taken from the concrete during placing. Tests shall be made at the beginning of concrete placement operation and at subsequent intervals to ensure that the specification requirements are met. Slump tests shall also be performed whenever standard cylinders are cast.

c. Tests for temperature and air content

(i) Temperature tests shall be made at frequent intervals during hot or cold weather conditions until satisfactory temperature control is established. Whenever standard cylinders are cast, temperature tests shall be performed.

(ii) Air content shall be as specified when measured in accordance with ASTM C231. Air content shall be measured whenever standard cylinders are cast.

D. Final Laboratory Report:

1. A final report, prepared by the testing laboratory, shall be provided at the completion of all concreting. This report shall summarize the findings concerning concrete used in the project and provide totals of concrete used by class and structure. Final quality control charts for compressive strength tests for classes of concrete specified in each major structure shall be included. The report shall also include the concrete batch plant's coefficient of variation and standard deviation results for each class of concrete as determined in accordance with ACI 214.

3.13 CLEANUP

A. Upon completion of the work and prior to final inspection, the Contractor shall clean all concrete surfaces. The cleaning procedures shall be as follows: After sweeping with an ordinary broom to remove the loose dirt, the surface shall be flushed with clean water. Final scrubbing by hand or machine shall follow.

END OF SECTION

SECTION 03 35 43

POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Installation of polished concrete floor system for new interior concrete floors by dry grinding, application of concrete densifier, and polishing with various size grit metal-bonded and resin-bonded diamonds to the scheduled specified minimum local and overall gloss values.
2. Application of chemical dye **and complementary edge band treatment**.

B. Related Sections:
1. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
2. Section 03 30 00 - Cast-in-Place Concrete.
3. Section 07 92 00 - Joint Sealants.
4. Section 09 65 00 - Resilient Flooring; Rubber base.

1.2 REFERENCES

A. ASTM C 1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.

B. ASTM D 523 - Standard Test Method for Specular Gloss.

C. NFSI - National Floor Safety Institute; Test Method 101A; current edition.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
1. For each type of chemical product indicated, submit current specifications and product literature, as printed by the manufacturer of the products specified herein.
2. Submit information on all grinding equipment to be used.
   a. Planetary grinder polishing equipment
   b. Planetary grinder HEPA dust collection equipment
   c. Hand tools
   d. Hand tool dust collection equipment
   e. Diamond tooling
   f. High speed propane burnisher
   g. Polyurea pump
   h. Joint cutting saw
3. Manufacturer’s chemical and product data sheets for:
   a. Specified dye
   b. Liquid reactive surface densifier
   c. Liquid stain guard treatment
   d. Joint filler
   e. Crack and spall repair product
   f. Self leveling, dye-able, polishable overlay product
   g. Grout coat, pin hole and small defect surface treatment
4. All proposed materials and methods of application are subject to review by the Architect and Owner.

C. Samples: Submit manufacturer's full color palette for concrete coloring materials.

D. Installer's Certification:
   1. Provide list of 5 projects performed with last three years of similar type, size and complexity. Submit project names, addresses, contacts and phone numbers for each project. General Contractor is to validate references and polisher's capabilities prior to submitting bid.
   2. Applicator Qualifications: Submit letter of certification from each of the following manufacturers of products and equipment specified herein, stating that the applicator is a certified applicator of the system and is familiar with proper procedures and installation methods as required by the manufacturer.
      a. Planetary grinder system
      b. Liquid reactive surface densifier and stain guard treatment
      c. Joint filler, crack and spall repair products

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements: Comply with applicable requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAGs) for Buildings and Facilities; Final Guidelines, revisions, and updates for static coefficient of friction for walkway surfaces.
   2. Environmental Requirements: Comply with current Federal and local toxicity and air quality regulations and with Federal requirements on content of lead, mercury, and other heavy metals. Do not use solvents in floor polish products that contribute to air pollution or impact food quality.

B. Qualifications:
   1. Installer trained and holding current certification for installation of specified products and polishing system.
   2. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project. Contractor shall have completed 5 jobs of similar size, scope and complexity within the last 2 years.
   3. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

C. Mock-Up: Prior to installation of dyed concrete finish system.
   1. **Mock-up shall not be a part of finished work and will be retained as a minimum standard of quality required for this work. Remove mock-up and dispose of materials when no longer required and when directed by Architect**.
   2. Mock-Up size will be 100 sq. ft. at project site at location as directed by Architect. Mock-up will be under conditions similar to those which will exist during actual placement.
   3. Mock-up will include properly repaired surface spalls, slab joints and slab edge treatments including complementary edge banding.
   4. Mock-up will be used to judge concrete substrate preparation, workmanship, operation of equipment, material application, color selection and shine.
   5. Allow a minimum of 24 hours for inspection of mock-up. Mock-up shall be accepted before proceeding with work and before any color or pattern work is started.

D. Pre-installation Meetings: Schedule and convene a pre-installation meeting at the project site before start of installation of polished concrete floor system
   1. Meeting to occur only after review and approval of required Sub-contractor submittals and completion of test panel mock-up, including specified grinding, polishing and dye, joint filling, spall and crack repairs, and specified overall gloss values.
   2. Required attendance of parties directly affecting work of this section, including:
      a. Project Architect
      b. Polishing Consultant, if retained on project.
      c. General Contractor
      d. Polishing Subcontractor including Project Manager and Foreman
   3. Pre-installation meeting agenda to verify project requirements, manufacturer's installation

instructions and manufacturer's warranty requirements. Review the following:
a. Existing conditions.
b. Environmental requirements.
c. Scheduling and phasing of work.
d. Coordinating with other work and personnel.
e. Protection of adjacent surfaces.
f. Surface preparation.
g. Repair of defects and defective work prior to installation.
h. Cleaning.
i. Installation of polished floor finishes.
j. Application of liquid hardener, densifier.
k. Protection of finished surfaces after installation.

1.5 PROJECT CONDITIONS

A. Sequence application of concrete polishing after completion of other construction activities that would be damaging to the completed polished concrete finish.

B. Close areas to traffic during and after floor application for time period recommended in writing by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original packaging with identification labels and seals intact.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

C. Waste Management and Disposal: Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.7 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's Warranty: Submit 10-year warranty signed by polished concrete contractor for failure and replacement of materials and workmanship executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

C. Warranty commences on date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Provide Polished Concrete Finishing Products by Ameripolish Concrete Polishing System™ (phone: 800.725.0033) or approved equal.
1. Machinery Requirements: HTC Systems Unit 800 or SASE Diamatic System Unit 780 or equivalent size and head pressure machinery made for grinding concrete.
2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
3. Low Viscosity Crack and Spall Repair: Rapid Refloor in complementary matching color, by Metzger McGuire or approved equivalent.
4. Wide Area Surface Repairs: Diama-Top by Ardex Engineered Cements or approved equivalent.
5. Pin Hole and Surface Pitting Grout Coat: Diama-Fill, by Ardex Engineered Cements or

approved equivalent.
6. Concrete Hardener, Densifier: Water based, odorless liquid, VOC compliant, chemical hardening solution leaving no surface film.
7. Concrete Colorant: Fast-drying dye, packaged in premeasured units ready for mixing with VOC exempt solvent; formulated for application to polished cementitious surfaces.
   a. Color: As scheduled in Color Schedule.
   b. Finish: Standard High gloss (HG-1), 1500 grit.
   c. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.
8. Cleaning Solution: Mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).

B. Design Requirements:
   1. Hardened Concrete Properties:
      a. Minimum Concrete Compressive Strength: 3500 psi.
      b. Normal Weight Concrete: No lightweight aggregate.
      c. Non-air entrained.
   2. Placement Properties:
      a. Natural concrete slump of 4-1/2 inches - 5 inches. Admixtures may be used.
      b. Flatness Requirements:
         1) Overall FF 40.
         2) Local FF 20.
   3. Hard-Steel Troweled (3 passes) Concrete:
      a. No burn marks. Finish to ACI 302.1R, Class 5 floor.
   4. Curing Options:
      a. Membrane forming curing compounds (ASTM C309, Type 1, Class B, all resin, dissipating cure).
         1) Acrylic curing and sealing compounds not recommended.
      b. Sheet membrane (ASTM C171); polyethylene film not recommended.
      c. Damp Curing: Seven day cure.

2.2 SYSTEM DESCRIPTION AND PERFORAMCE

A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following:
   1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch wear in 30 minutes.
   2. Reflectivity: Increase of 35% as determined by standard gloss meter.
   3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.
   4. High Traction Rating: NFSI 101-A, non-slip properties.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.

B. Verify Concrete Slab Performance Requirements:
   1. Verify concrete is cured to 28 day, at strength as specified in Section 03 30 00 - Cast-In-Place Concrete.
   2. Floor and Joints: Dry and free of debris and excessive dirt, dust, clay, and mud.
   3. Floor Finish: Wide channel floated, smooth, pan, combination blade and plastic blade finished floor from edge to edge, with no rough areas. Verify concrete surfaces received a hard steel-trowel finish (3 passes) during placement.

4. Concrete Adjacent to Floor Penetrations: Troweled flat and level with surrounding concrete.

C. Notify the General Contractor in writing of conditions that would adversely affect installation or subsequent use prior to commencement of polishing.

D. Do not begin surface preparation or installation until conditions are corrected and approved.

3.2 PREPARATION

A. Examine surface to determine soundness of concrete for polishing.

B. Remove surface contamination, fins and projections.

C. Chalk lines laid out for any purpose are acceptable as long as they are not sprayed down with clear acrylic.

D. Protection: Protect surrounding areas and adjacent surfaces from the following:
1. Minimal accumulation of dust from grinding and polishing.
2. Contact with overspray of penetrating hardener / densifier.
3. Contact with overspray of protective surface treatment (stain guard)
4. Contact with overspray of water or solvent based dye treatment.
5. Contact with joint filler, crack or spall repair materials

E. Clean Surfaces: Remove dirt, dust, debris, oil, grease, curing agents, bond breakers, paint, coatings, and other surface contaminants which could adversely affect installation of polished concrete floor system.

3.3 INSTALLATION

A. Install polished concrete floor system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Aggregate Exposure:
1. Fine Aggregate: Mottled salt-and-pepper aggregate exposure.

C. Polished Concrete Floor System
1. Open Slab Surface:
   a. As required to provide a uniform final polish or removal of existing floor coatings, begin grinding with 40 or 80-grit metal bond. Bids shall be based on starting initial cut with 40-grit metal diamonds. Expose coarse concrete aggregate when required to reach lows spots within floor surface.
   b. Review condition of floor. Obtain written approval if large coarse aggregate is required to be exposed to remove existing coatings, floor underlayment or slab deficiencies. Variations to the precise grinding, densifying, polishing, dying and stain guard application are anticipated, but must be discussed and approved in writing prior to executing the work.
   c. For new concrete floors, open-up concrete by grinding with 80-grit metal-bonded.
   d. Progressive edge grinding will be necessary with ½" of all vertical abutments, including walls, cases, columns, posts and racking systems.
   e. Joint filler and spall repairs shall be flush with surface after grinding and polishing steps. Additional passes along curled joints may be necessary to remove joint filler chatter.
2. Remove metal-bonded diamond scratches by grinding with progressively finer metal-bonded diamonds, up to metal bond 150-grit.
3. Apply densifier
   a. Per manufacturer's recommendations and the concrete's acceptance of the product.
4. Floor Polishing:
   a. Remove 150-grit metal-bonded diamond scratches by grinding with a transitional diamond per manufacturers recommendation
   b. Remove transitional resin-bonded diamond scratches by grinding with 100-grit resin-

bonded diamonds.
   c. Remove 100-grit resin-bonded diamond scratches by grinding with 200-grit resin-bonded diamonds.
   d. Remove 200-grit resin-bonded diamond scratches by grinding with 400-grit resin-bonded diamonds.
   e. Remove 400-grit resin-bonded diamond scratches by grinding with 800-grit resin-bonded diamonds.
   f. Remove 800-grit resin-bonded diamond scratches by grinding with 1500-grit resin-bonded diamonds.
5. Apply stain guard
   a. Apply in accordance with manufacturer's published instructions.
   b. Apply first coat per manufacturer's recommendation (DO NOT OVER APPLY).
   c. Use applicator pad, pre-wetted with stain guard, to pull material out to create a thin film prior to drying.
   d. Remove product completely from areas of over application, as evidenced by surface streaking, and replace with unused stain guard.
   e. Apply second coat of stain guard at all high traffic areas identified on the drawings per manufacturer's instructions.
6. High speed burnish:
   a. After each application of stain guard is dry, burnish surface.
   b. Burnish using approved pads, at a slow movement pace using high speed machine with 400 or 800 grit diamond impregnated pads as required to achieve specified gloss requirements.
   c. Burnish with several passes. Make each progressive pass at 90 degrees from previous pass.
   d. Burnishing, pad type, and pace of forward movement shall combine to develop a minimum floor surface temperature of 91-degrees F directly below the burnishing pad as continuously measured by the operator during installation.

D. Penetrating Dye
1. Mix dye in accordance with installer's instructions.
2. Where shown on Architectural drawings, saw-cut reveal line around room periphery. Use Mongoose concrete saw or similar to cut precise intercepts. Use tape and protection along saw cut to prevent main floor dye from penetrating concrete surface to receive edge band.
3. Apply 2-coats of AmeriPolish or approved equivalent solvent based dye color per plans.
4. Apply penetrating dye after 200 or 400-grit resin-bonded diamond-grinding step in accordance with manufacturer's recommendations and approved mock-up.
5. Thoroughly auto-scrub surface clean of excess dye residue in accordance with manufacturer's instructions.
6. Repeat application of penetrating dye if due to porosity of floor or darker color is desired as selected by Architect. Bids shall be based on providing 2 applications of Dye.

3.4 FIELD QUALITY CONTROL

A. Inspect completed polished concrete floor system with the Architect, Concrete Consultant, General Contractor, and Polished Concrete Installer.

B. Review procedures with owners Consultant to correct unacceptable areas of completed polished concrete floor system.

C. Specular Gloss/Reflectance, ASTM D 523:
1. Perform polishing and burnishing work necessary to produce a Specified Overall Gloss Value (SOGV) ≥ 50 prior to applying protective surface treatment, SOGV ≥ 60 after applying protective surface treatment, Minimum Local Gloss Value (MLGV) ≥ 40 after applying protective surface treatment as measured using a Horiba IG-320 60 Degree Gloss Checker.
2. Gloss shall be considered as a quantitative value that expresses the degree of reflection when light hits the concrete floor surface. Gloss measurements will be taken independent of ambient lighting and will be taken within a sealed measurement window located beneath the test unit.
3. Collects 12 readings minimum, throw out low and high measurements and average

remaining measurements. Average shall exceed SOGV. No single measurement shall be less than MLGV.

3.5 ADJUSTMENTS

A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface.

3.6 FINAL CLEANING

A. Final clean in accordance with Section 01 74 13 - Progress Cleaning.

B. Mechanically scrub treated floors for seven days with soft to medium pads with approved cleaning solution.

C. Clean adjacent materials and surfaces and work area of foreign materials resulting from work of this section.

D. Upon completion, contractor must remove surplus and excess materials, rubbish, tools and equipment.

3.7 PROTECTION

A. Protect completed polished concrete floor system from damage until Substantial Completion.
   1. Do not allow vehicle and pedestrian traffic on unprotected floor.
   2. Do not allow construction materials, equipment, and tools on unprotected floor.
   3. Prohibit parking of vehicles on concrete slab.
   4. Protect from petroleum stains during construction.
   5. If construction equipment must be used for application, diaper components that might drip oil, hydraulic fluid, or other liquids. This is especially important with hydraulic lifts.
   6. No tire embedments (rocks, nails, screws, etc.) that will scratch or pit slab surface.
   7. Check lift tires daily for screws.
   8. Prohibit pipe cutting using pipe cutting machinery on concrete slab.
   9. Prohibit temporary placement and storage of steel members or reinforcing steel on concrete slab.
   10. Prohibit acids and acidic detergents from contacting concrete surfaces.
   11. Cover concrete floors with drop cloths or use breathable drop cloths during painting. If paint is spilled on concrete floor, remove paint immediately.
   12. Protect slab surface from standing moisture for 72 hours to prevent re-emulsification of surface treatment prior to cure

B. Protect adjacent materials from damage during installation of polished concrete.

C. Chalk lines laid out for any purpose are acceptable as long as they are not sprayed down with clear acrylic.

D. Immediately remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants which could adversely affect completed polished concrete floor system.

E. Repair damaged areas of completed polished concrete floor system to satisfaction of the Architect and owners Consultant.

F. Protect completed areas with EZ Cover™ by McTech Corp. (phone: 866.913.8363 website: http://www.mctechgroup.com/ezcover.html), or comparable product.

END OF SECTION

SECTION 033905

CONCRETE CURING (RETAINING WALL)

PART 1 GENERAL

1.1 SUMMARY

A. Section includes initial and final curing of horizontal and vertical concrete surfaces.

1.2 SUBMITTALS

A. Product Data: Curing compounds, Mats, Paper, Film, compatibilities, and limitations.

1.3 QUALITY ASSURANCE

A. Perform Work according to ACI 318.

B. Perform Work according to applicable codes.

PART 2 PRODUCTS

2.1 MATERIALS

A. Water: Potable, not detrimental to concrete.

PART 3 EXECUTION

3.1 INSTALLATION - HORIZONTAL SURFACES

A. Cure concrete according to ACI 308.1.

B. Membrane Curing Compound: Apply curing compound in two coats with second coat applied at right angles to first.

3.2 INSTALLATION - VERTICAL SURFACES

A. Cure concrete according to ACI 308.1.

B. Membrane Curing Compound: Apply compound in two coats with second coat applied at right angles to first.

3.3 SCHEDULES

A. Storage Area Slabs: Absorptive mats, burlap-polyethylene type.

B. Retaining Walls: Membrane curing compound, acrylic type, clear color.

C. Concrete Pavement: Membrane curing compound, opaque color.

D. Other Floor Areas: Membrane curing compound, acrylic type, translucent color.

END OF SECTION

SECTION 04 2000

UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete Block.

B. Reinforcement and Anchorage.

C. Accessories.

D. Section does not include masonry veneer products.

1.2 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2013.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016.

G. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

J. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

K. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2015.

L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

M. ASTM C476 - Standard Specification for Grout for Masonry; 2016.

N. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013.

O. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).

P. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.

Q. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

R. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014a.

1.3 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

D. LEED Submittal Cover Sheet: Fill in the form, attached following this Section, and submit completed form with submittal.

1.4 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on the drawings for specific locations.
2. Special Shapes: Provide non-standard blocks configured for corners.
3. Load-Bearing Units: ASTM C90, medium weight.

a. Hollow block, as indicated.
b. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.2 MORTAR AND GROUT MATERIALS

A. Mortar: Type S mortar. Incorporate color pigment in mortar for in amounts required to achieve desired color as required by architect.

B. Grout: Comply with ASTM C 476. Reference structural general notes for required grout strength.

C. Masonry Cement: ASTM C91/C91M, Type N.

D. Hydrated Lime: ASTM C207, Type S.

E. Mortar Aggregate: ASTM C144.

F. Grout Aggregate: ASTM C404.

G. Water: Clean and potable.

H. Integral Water Repellent Admixture for Mortar and Grout: Polymeric liquid admixture added to mortar and grout at the time of manufacture.

1. Use only in combination with masonry units manufactured with integral water repellent admixture.
2. Use only water repellent admixture for mortar and grout from the same manufacturer as water repellent admixture in masonry units.
3. Meet or exceed performance specified for water repellent admixture used in masonry units.

I. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

1. Type: Type N.
2. Color: Standard gray.
3. Water-repellent mortar for use with water repellent masonry units.

2.3 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars.

B. Single Wythe Joint Reinforcement: Ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483-inch side rods with 0.1483-inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

2.4 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

1. Masonry below grade and in contact with earth: Type S.
2. Exterior, loadbearing masonry: Type N.
3. Exterior, non-loadbearing masonry: Type N.
4. Interior, loadbearing masonry: Type N.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.2 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.3 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high-pressure cleaning methods.

D. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.4 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.5 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

END OF SECTION

SECTION 04 73 25
THIN MASONRY STONE (ADHERED)

PART 1 – GENERAL

1.01 SUMMARY
A. Scope of work - Provide manufactured adhered veneer (units size thickness ranging from a minimum ¼" [6mm] up to a maximum 2-5/8" [65mm] according to IBC – Chapter 14 Exterior Walls or applicable local building codes for thin adhered masonry veneer), veneer installation materials and accessories as indicated on drawings, as specified herein, and as needed for complete and proper installation.
B. Related Documents - provisions within General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings apply to this Section.

1.02 SECTION INCLUDES
A. Thin adhered calcium silicate Building Stone masonry units (also referenced as thin CSMU) ARRIS▪stack Units
B. Installation Products; adhesives, mortars, grouts and sealants
C. Air and Water Barriers

1.05 ENVIRONMENTAL PERFORMANCE REQUIREMENTS
A. Environmental Performance Criteria: The following criteria are required for products included in this section.

Refer to Division 1 for additional requirements:

1. Adhesive products must meet or exceed the VOC limits of AHJ and LEED Requirements.

1.06 RELATED SECTIONS
A. Section 03 03 00 Cast-in-Place Concrete
B. Section 07 09 00 Joint Sealers: Perimeter sealing at Openings
C. Section 07 14 00 Fluid Applied Waterproofing
D. Section 07 62 00 Sheet Metal flashing and Trim: Veneer Flashing
E. Section 07 92 00 Elastomeric Joint Sealants
F. Section 09 29 00 Glass Mat Sheathing

1.09 REFERENCE STANDARDS
A. American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members
B. American National Standards Institute (ANSI) A118.1 - A118.12 American National Standard Specifications For The Installation Of Ceramic Tile
C. ICC-ES AC212 - WATER-RESISTIVE COATINGS USED AS WATER-RESISTIVE BARRIERS OVER EXTERIOR SHEATHING
D. American Plywood Association (APA) Y510T Plywood Design Specifications
E. American Society For Testing And Materials (ASTM) C36 Standard Specification for Gypsum Wallboard
F. American Society For Testing And Materials (ASTM) C482 Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement
G. American Society For Testing And Materials (ASTM) C847 Standard Specification for Metal Lath
H. American Society For Testing And Materials (ASTM) C920 Standard Specification for Elastomeric Joint Sealants
I. American Society For Testing And Materials (ASTM) C955 Standard Specification for Load Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases
J. American Society For Testing And Materials (ASTM) E96 Standard Test Methods for Water Vapor Transmission of Materials

K. Canadian Sheet Steel Building Institute (CSSBI) Lightweight Steel Framing Binder {Publication 52M}
L. Metal Lath/Steel Framing Association (ML/SFA) 540 Lightweight Steel Framing Systems Manual
M. Steel Stud Manufacturers Association (SSMA) Product Technical Information and ICBO Evaluation Service, Inc. Report ER-4943P

1.10 SYSTEM DESCRIPTION

A. Thin Adhered CSMU Building Stone installed over steel framing, exterior rated sheathing, liquid air and water barrier , and Masonry Veneer Engineered System (Sto MVES or Similar Approved).

1.11 SUBMITTALS

A. Submit profile drawings and manufacturers' product data under provisions of Section (01 33 23).
B. Submit three (3) samples of each type/style/finish/size/color of adhered masonry veneer and trim unit under provisions of Section 01 33 23.
C. Submit manufacturers' installation instructions under provisions of Section 01 33 23.
D. Submit proof of warranty.
E. Submit sample of installation system demonstrating compatibility/functional relationships between air barriers, waterproofing membranes, adhesives, mortars pointing mortars and other components under provision of Section 01 33 23.
F. For alternate materials, at least thirty (30) days before bid date submit independent laboratory test results confirming compliance with specifications listed in Part 2 - Products.

1.12 QUALITY ASSURANCE

A. Adhered Masonry Veneer Manufacturer (single source responsibility): Company specializing in adhered masonry veneer, trim units with Five (5) years minimum experience. Obtain adhered masonry veneer from a single source with resources to provide products of consistent quality in appearance and physical properties.
B. Installation System Manufacturer (single source responsibility): Company specializing in air barriers, waterproofing membranes, adhesives, mortars pointing mortars and other installation materials with ten (10) years minimum experience and ISO 9001 certification. Obtain installation materials from single source manufacturer to insure consistent quality and full compatibility.
C. Submit positive laboratory testing to confirm applicability of air barrier, waterproofing membranes, adhesives, mortars pointing mortars, and other installation materials for specified job conditions.
D. Installer qualifications: company specializing in installation of adhered masonry veneer and trim units with five (5) years documented experience with installations of similar scope, materials and design.

1.13 MOCK-UPS

A. Provide mock-up of each type/style/finish/size/color of adhered masonry veneer and trim unit along with respective installation air barrier, waterproofing membranes, adhesives, mortars pointing mortars and other installation materials, under provisions of Section 013323.

1.14 PRE-INSTALLATION CONFERENCE

A. Pre-installation conference: At least three weeks prior to commencing the work attend a meeting at the jobsite to discuss conformance with requirements of specification and job site conditions. Representatives of owner, architect, general contractor, adhered masonry veneer subcontractor, adhered masonry veneer manufacturer, Installation System Manufacturer and any other parties who are involved in the scope of this installation must attend the meeting.

1.15 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01 66 00.
B. Deliver calcium silicate building stone masonry units in protective film. Prevent damage to units.

C. Lift skids with proper and sufficiently long slings or forks with protection to prevent damage to units. Protect edges and corners.
D. Store units in a manner designed to prevent damage and staining of units.
E. Stack units on timbers or platforms at least 3 inches above grade.
F. Place polyethylene or other plastic film between wood and other finished surfaces of units when stored for extended periods of time.
G. Cover stored units with protective enclosure if exposed to weather.
H. Do not use salt or calcium-chloride to remove ice from masonry surfaces.
I. Store adhered masonry veneer and installation system materials in a dry location; handle in a manner to prevent chipping, breakage, and contamination.
J. Protect latex additives, liquid air barriers, waterproofing membranes, epoxy adhesives and sealants from freezing or overheating in accordance with manufacturer's instructions; store at room temperature when possible.
K. Store portland cement mortars and pointing mortars in a dry location.

1.16 PROJECT/SITE CONDITIONS
A. Provide ventilation and protection of environment as recommended by manufacturer.
B. Prevent carbon dioxide damage to adhered masonry veneer, trim, as well as adhesives, liquid air and water barrier ,mortars, pointing mortars and other installation materials, by venting temporary heaters to the exterior.
C. Maintain ambient temperatures not less than 37ºF (3ºC) or more than 100ºF (38ºC) during installation and for a minimum of seven (7) days after completion. Setting of portland cement is retarded by low temperatures.
   1. Protect work for extended period of time and from damage by other trades.
   2. Epoxy mortars and epoxy pointing mortars require surface temperatures between 60ºF (16ºC) and 90ºF (32ºC) at time of installation.
   3. Liquid air barrier and waterproofing Membranes require surface temperatures between 50ºF (10ºC) and 90ºF (32ºC). It is the General Contractor’s responsibility to maintain temperature control.

1.17 SEQUENCING AND SCHEDULING
A. Coordinate installation of adhered masonry veneer work with related work.
B. Proceed with adhered masonry veneer work only after curbs, vents, drains, piping, and other projections through substrate have been installed and when substrate construction and framing of openings have been completed.

1.18 WARRANTY
A. Thin Adhered CSMU Building Stone installed over concrete masonry unit substrate:
   1. The Contractor warrants the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of 25 years. The manufacturer of adhesives, liquid air and water barrier, mortars, pointing mortars and other installation materials shall provide a written twenty five (25) year warranty, which covers materials and labor - reference LATICRETE Warranty Data Sheet 025.0SPD for complete details and requirements.
B. Thin Adhered CSMU Building Stone installed over steel or wood framing
   1. The Contractor warrants the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of 15 years. The manufacturer of adhesives, liquid air and water barrier, mortars, pointing mortars and other installation materials shall provide a written twenty five (15) year warranty, which covers materials and labor - reference LATICRETE Warranty Data Sheet 230.15SPD for complete details and requirements.

1.19 EXTRA MATERIAL STOCK

A. Extra stock is to be from same production run or batch as original adhered masonry veneer and installation materials.
B. Upon completion of the work of this Section, deliver to the Owner 2% minimum additional adhered masonry veneer and trim shapes or a minimum of 2 additional pieces of each type, color, pattern and size used in the Work, as well as extra stock of adhesives, mortars, pointing mortars and other installation materials for the Owner's use in replacement and maintenance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
Subject to compliance with paragraphs 1.12 and performance requirements, provide products by one of the following manufacturers:
A. Manufacturers of Thin calcium silicate building stone units having Products considered acceptable for use:
1. Basis of Design: Arriscraft International, as distributed by Upchurch Kimbrough, *ARRIS▪stack in* ***Desert Sand 5-7/8" Thin-Clad Units*****.**

2. Substitution Procedures: refer to Instructions to Bidders and Section 01 25 00.

B. Manufacturers of Adhered Masonry Veneer Installation Materials and Accessories having Products considered acceptable for use:
1. Basis of Design: StoTherm ci Masonry Veneer Engineered System (MVES)

2. Substitution Procedures: refer to Instructions to Bidders and Section 01 25 00.

2.02 ADHERED MASONRY VENEER MATERIALS
A. Thin Adhered Calcium Silicate Building Stone Masonry Units (Thin Adhered CSMU) (Georgia): to ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; special shapes as indicated; three-size configuration; as follows:
1. Modular Sizes:
a. AS21: 2-1/8" high, random thickness, random lengths.
b. AS35: 3-5/8" high, random thickness, random lengths.
c. AS56: 5-13/16" high, random thickness, random lengths.
2. Texture: rugged chiselled finish on exposed faces;
3. Color: Desert Sand is used; Split faced
4. Product and Manufacturer's Name: ARRIS▪stack Building Stone by Arriscraft International.

2.03 StoTherm Ci Masonry Veneer Engineered System (MVES)
A. Provide all components as an integrated system per the manufacturer's recommendations.
1. StoGuard Air and Water-resistive barrier w/ Sto Gold Coat
2. Sto Turbo Stick foam adhesive
3. 2" Sto EPS Foam Exterior Insulation Board
4. Sto 6oz Mesh
5. Sto Primer/Adhesive
6. Fasteners w/ Plates through all layers
7. StoColl Masonry Veneer Adhesive

** GREENGUARD Indoor Air Quality Certified® Product

PART 3 – EXECUTION

3.01 EXAMINATION
A. Verify site conditions are ready to receive work

B. Inspect materials for fit and finish prior to installation. Do not set unacceptable units.
C. Beginning of installation means acceptance of existing conditions.

3.02 CUTTING MASONRY UNITS
A. Cut masonry units with wet-saw.
B. Pre-soak units using clean water prior to cutting.
C. Clean cut units using a stiff fibre brush and clean water. Allow units to surface dry prior to placement.
D. Finish cut edges to match face when exposed in wall.

3.03 COURSING
A. Place masonry to lines and levels indicated.
B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
C. Lay building stone units in random bond pattern, to the following percentage ratio, described from smallest to largest sized units: [30:55:15].

3.04 FIELD QUALITY CONTROL
A. Perform inspection and testing as specified in Section 01 45 23.
B. [Architect][Engineer] Inspection: [Architect][Engineer] will inspect installed masonry and reject masonry that is chipped, cracked, or blemished (streaked, stained or otherwise damaged), as described below.
   1. Masonry will be inspected to be free of cracks or other blemishes on the finished face or front edges of the masonry units exceeding 3/8 inch or that can be seen from a distance of 10 feet.
   2. Units shall exhibit a texture approximately equal to the approved sample when viewed under diffused daylight illumination at a 20 foot distance.
   3. Minor chipping or breakage resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under diffused daylight illumination from a 20 foot distance.
   4. Efflorescence will not be cause for rejection.
C. Make Good rejected masonry as directed by Architect.

3.05 ADJUSTING AND CLEANING

A. Clean a 100 square foot area of wall designated by Architect as directed below and leave for one week. If no harmful effects appear, all objectionable stains have been removed and after mortar has set and cured, clean masonry as follows:
   1. Protect windows, sills, doors, trim and other work from damage.
   2. Remove large particles with stiff fiber brushes without damaging surface.
   3. Saturate masonry with clean water and flush off loose mortar and dirt.
   4. Dilute cleaning agent with clean water in controlled proportions.
   5. Apply solution to pre-soaked wall surface using soft-bristled brush.
   6. Thoroughly rinse cleaning solution and residue from wall surface.

B. Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with masonry unit manufacturer.

3.06 PROTECTION
A. Protect units from damage resulting from subsequent construction operations.
B. Use protection materials and methods which will not stain or damage units.
C. Remove protection materials upon Substantial Completion, or when risk of damage is no longer present.

3.07 SUBSTRATE EXAMINATION

A. Verify site conditions are ready to receive work.
B. Inspect finish materials for fit and finish prior to installation. Do not set unacceptable units.
C. Beginning of installation means acceptance of existing conditions.
D. Verify that surfaces to be covered with adhered masonry veneer, brick, stone, trim or waterproofing are: Sound, rigid and conform to good design/engineering practices;
    a. Systems, including the framing system (including lateral bracing, purlins, battens and other framing member stiffeners), flashings, water resistive barriers, air barriers, exterior rated sheathing panels, cement backer unit panels, wire lath over which adhered masonry veneer or stone will be installed shall be in conformance with the International Residential Code (IRC) for residential applications, the International Building Code (IBC) for commercial applications, or applicable building codes. The project design should include the intended use and necessary allowances for the expected live load, concentrated load, impact load, and dead load including the weight of the finish and installation materials while maintaining the maximum allowable deflection standard of L/600 under total anticipated load;
    b. Clean and free of dust, dirt, oil, grease, sealers, curing compounds, laitance, efflorescence, form oil, loose plaster, paint, and scale;
    c. Adhered Masonry Veneer installations have a specified subsurface tolerance, for instance ¼" in 10' (6mm in 3m) and 1/16" in 1' (1.5mm in 300mm), to conform with the ANSI specifications. Because medium-bed mortars are not intended to be used in truing or leveling the work of others, the subsurface typically should not vary by more than 1/16" over 1' (1.5mm over 300mm), nor more than 1/32" (0.8mm) between adjoining edges where applicable (e.g. between sheets of cement backer board or between adjacent concrete masonry units). Should the architect/designer require a more stringent tolerance (e.g. 1/8" in 10' [3mm in 300mm]), the subsurface specification must reflect that tolerance, or the adhered masonry veneer specification must include a specific and separate requirement to bring the ¼" (6mm) subsurface tolerance into compliance with the 1/8" (6mm) tolerance desired;
    d. Not leveled with gypsum or asphalt based compounds;
    e. Dry as per American Society for Testing and Materials (ASTM) D4263 "Standard Test for Determining Moisture in Concrete by the Plastic Sheet Method."
E. Concrete surfaces shall also be:
    a. Cured a minimum of 28 days at 70°F (21°C), including an initial seven (7) day period of wet curing;
    b. Wood float finished, or better, if the installation is to be done by the medium bed method;
F. Advise General Contractor and Architect of any surface or substrate conditions requiring correction before adhered masonry veneer work commences. *Beginning of work constitutes acceptance of substrate or surface conditions.*

3.08 SURFACE PREPARATION

A. Install DRAINAGE MAT over the exterior grade primary sheathing and Laticrete Air & Water Barrier or over concrete surfaces and Laticrete Air & Water Barrier. Install in accord with drainage mat manufacturers installation instructions.

B. MVES SUBSTRATES
Install per manufacturer requirements for a water tight installation as an integrated system.

3.09 INSTALLATION ACCESSORIES

A. Pre-Treat Cracks and Joints - Fill all substrate cracks, cold joints and control joints to a smooth finish using a LATICRETE latex-fortified mortar. Alternatively, a liberal coat* of LATICRETE Air and Water Barrier applied with a paint brush or trowel may be used to fill in non-structural joints and cracks. Apply a liberal coat* of LATICRETE Air and Water Barrier approximately 8" (200mm) wide over substrate cracks, cold joints, and control joints using a paint brush or heavy napped paint roller.

B. *Pre-Treat Coves and Floor/Wall Intersections* - Fill all substrate coves and floor/wall transitions to a smooth finish and changes in plane using a LATICRETE latex-fortified mortar. Alternatively, a liberal coat* of LATICRETE Air and Water Barrier applied with a paint brush or trowel may be used to fill in cove joints and floor/wall transitions <1/8" (3mm) in width. Apply a liberal coat* of LATICRETE Air and Water Barrier approximately 8" (200mm) wide over substrate cracks, cold joints, and control joints using a paint brush or heavy napped paint roller.

C. *Main Application* - Allow any pre-treated areas to dry to the touch. Apply a liberal coat* of StoGuard/StoGold Air and Water Barrier with a paint brush or heavy napped roller over substrate including pre-treated areas and allow to dry to the touch. Install another liberal coat* of StoGuard/StoGold Air and Water Barrier over the first coat. Let the top coat of StoGuard/StoGold Air and Water Barrier dry to the touch approximately 1 – 2 hours at 70°F (21°C) and 50% RH. When the top coat has dried to the touch inspect the surface for pinholes, voids, thin spots or other defects. StoGuard/StoGold Air and Water Barrier will dry to an olive green color when fully cured. Use additional StoGuard/StoGold Air and Water Barrier to seal any defects.

D. *Treat Penetrations and Flashings* - Allow for a minimum 1/8" (3mm) space between drains, pipes, lights, or other penetrations and surrounding adhered masonry veneer. Flash LATAPOXY Waterproof Flashing Mortar onto and around penetration openings to create a waterproof seal. Bring LATAPOXY Waterproof Flashing Mortar up to the finish level of the adhered masonry veneer, thin brick or stone finish. When LATAPOXY Waterproof Flashing Mortar has dried to the touch and the finishes have been installed, seal the gap around the penetration with LATICRETE Latasil.

E. *Movement Joints* - Apply a liberal coat* of StoGuard/StoGold Air and Water Barrier, approximately 8" (200mm) wide over the areas. Then embed and loop the 6" (150mm) wide Sto Waterproofing/Anti-Fracture Fabric and allow the StoGuard/StoGold Air and Water Barrier liquid to bleed through. Immediately apply a second coat of StoGuard/StoGold Air and Water Barrier.

F. Dry coat thickness is 20 – 30 mil (0.02 - 0.03" or 0.5 - 0.8mm); consumption per coat is approximately 0.01 gal/ft^2 (approx. 0.4 L/m^2); coverage is approximately 100 ft^2 /gal (approx. 2.5 m^2/ L). StoGuard/StoGold Waterproofing/Anti-Fracture Fabric can be used to pre-treat cracks, joints, curves, corners, drains, and penetrations with StoGuard/StoGold Air and Water Barrier.

G. *Protection* - Provide protection for newly installed membrane, even if covered with a adhered masonry veneer installation against exposure to rain or other water for a minimum of 2 hours at 70°F (21°C) and 50% RH. For temperatures between 45°F and 69°F (7°C to 21°C) allow a minimum 24 hour cure period.

Use the following Sto System Materials:
a. StoGuard/StoGold Air and Water Barrier

3.10 INSTALLATION – ADHERED MASONRY VENEER

A. *General:* Install in accordance with current versions of American National Standards Institute, Inc. (ANSI) "A108 American National Standard Specifications for Installation of Ceramic Tile" and TCNA "Handbook for Ceramic Tile Installation." Cut and fit adhered masonry veneer neatly around corners, fittings, and obstructions. Perimeter pieces to be minimum half unit , brick or stone. Chipped, cracked, split pieces and edges are not acceptable. Make joints even, straight, plumb and of uniform width to tolerance +/- 1/16" over 8' (1.5mm in 2.4m). Install divider strips at junction of flooring and dissimilar materials.

B *Pre-float Method:* Over clean, dimensionally stable and sound concrete or masonry substrates, apply thick-bed mortar as scratch/leveling coat in compliance with current revision of A108.1A (1.0, 1.4 & 5.1). Float surface of scratch/leveling coat plumb, true and allow mortar to set until firm. For installation of adhered masonry veneer follow Direct Adhere Method (§ 3.4 D).

Use the following Sto System Materials:
StoPowerwall Stucco

C

D *Direct Adhere Method to Install Masonry Veneer:* Install latex portland cement mortar in compliance with current revisions of ANSI A108.02 (3.11), A108.1B and ANSI A108.5. Use the appropriate trowel notch size to ensure proper bedding of the adhered masonry veneer, selected so that 100% coverage of the back surface of the Thin Adhered CSMU is achieved. Work the latex portland cement mortar into good contact with the substrate and comb with notched side of trowel. Spread only as much latex portland cement mortar as can be covered while the mortar surface is still wet and tacky. When installing large format (>8" x 8"/200mm x 200mm) units, spread latex portland cement mortar onto the back of (i.e. 'back-butter') each piece/unit in addition to troweling latex portland cement mortar over the substrate. Beat each piece/unit into the latex portland cement mortar with a beating block or rubber mallet to insure 100% full bedding and flatness. Allow installation to set until firm. Clean excess latex portland cement mortar from adhered masonry veneer face and joints between pieces.

Use the following Sto System Materials:
StoColl Masonry Veneer Mortar

E. *Pointing Joints (NOTE: Stacked Stone Installations to omit pointing of mortar joints)*

Polymer Fortified Pointing Mortar - for joint widths ≥1/16"(1.5mm) and ≤1" (25mm]); Allow Thin Adhered CSMU veneer to cure a minimum of 24 hours @ 70° F (21°C).? Verify grout joints are free of dirt, debris, wedges or spacers. Sponge or wipe dust/dirt off veneer face and remove any water standing in joints. Surface temperature must be between 40-90° F (4-32°C). Pour approximately 4 quarts (3.8 L) of clean, potable water into a clean mixing container. Add a 50 lb. (22.7 kg) bag of LATICRETE Masonry Pointing Mortar to the container while mixing. Mix by hand or with a slow speed mixer to a smooth, stiff consistency. Install latex fortified cement grout in compliance with current revisions of ANSI A108.1A (7.0), ANSI A108.02 (4.5) and ANSI A108.10. Dampen dry surfaces with clean water.

Place LATICRETE Masonry Pointing Mortar into a high quality masonry mortar pointing bag. Carefully bag the pointing mortar into the joints. Once the mortar has become stiff in the joint, ("thumb-print dry") typically 15-20 minutes after pointing @ 70° F (21°C), using a striking or joint tool, strike the mortar joints to the desired finish/contour. Remove excess mortar using a masonry brush or sponge. Do not over wash the mortar joint.

Higher temperatures may require faster time to initial cleaning; wider joints or lower temperatures may require a longer time to initial cleaning. Allow grout joints to become firm. Inspect joint for pinholes/voids and repair them with freshly mixed grout. Within 24 hours, check for remaining haze and remove it with warm soapy water and a nylon scrubbing pad, using a circular motion, to lightly scrub surfaces and dissolve haze/film. Do not use acid cleaners on latex portland cement grout less than 10 days old.

F. *Expansion and Control Joints:* Provide control or expansion joints as located in contract drawings and in full conformity, especially in width and depth, with architectural details.
1. Substrate joints must carry through, full width, to surface of adhered masonry veneer.
2. Install expansion joints in adhered masonry veneer work over construction/cold joints or control joints in substrates.
3. Install expansion joints where adhered masonry veneer abut restraining surfaces (such as perimeter walls, curbs, columns), changes in plane and corners.
4. Joint width and spacing depends on application - follow TCNA "Handbook for Ceramic Tile Installation" Detail "EJ-171 Expansion Joints" or consult sealant manufacturer for recommendation based on project parameters.
5. Joint width: ≥ ⅛" (3mm) and ≤ 1" (25mm).
6. Joint width: depth ~2:1 but joint depth must be ≥ ⅛" (3mm) and ≤ ½" (12mm).

7. Layout (field defined by joints): 1:1 length: width is optimum but must be ≤ 2:1. Remove all contaminants and foreign material from joint spaces/surfaces, such as dirt, dust, oil, water, frost, setting/grouting materials, sealers and old sealant/backer. Use LATICRETE Latasil™ 9118 Primer for underwater and permanent wet area applications, or for porous stone (e.g. limestone, sandstone etc…) installations. Install appropriate backing material (e.g. closed cell backer rod) based on expansion joint design and as specified in § 07920. Apply masking tape to face of adhered masonry veneer, brick or stone veneer. Use caulking gun, or other applicator, to completely fill joints with sealant. Within 5-10 minutes of filling joint, 'tool' sealant surface to a smooth finish. Remove masking tape immediately after tooling joint. Wipe smears or excess sealant off the face of adhered masonry veneer or other absorptive surfaces immediately.

Use the following LATICRETE System Materials:
LATICRETE® Latasil™
LATICRETE Latasil 9118 Primer

G. *Adjusting*: Correction of defective work for a period of one (1) year following substantial completion, return to job and correct all defective work. Defective work includes, without limitation, adhered masonry veneer units stones broken in normal abuse due to deficiencies in setting bed, loose grout, and all other defects which may develop as a result of poor workmanship.

3.11 CLEANING

Clean excess mortar/epoxy from veneer surfaces with water before they harden and as work progresses. Do not contaminate open grout/caulk joints while cleaning. Sponge and wash veneers diagonally across joints. Do not use acids for cleaning. Polish with clean dry cloth. Remove surplus materials and leave premises broom clean.

3.12 PROTECTION

A. Protect finished installation under provisions of §01 05 00 and §01 05 35. Close areas to other trades and traffic until adhered masonry veneer being installed has set firmly. Cure work in swimming pools, fountains and other continuous immersion applications for 14 days for latex portland cement based pointing mortar @ 70°F (21°C) before flood testing or filling installation with water. Extend period of protection of veneer work at lower temperatures, below 60°F (15°C), and at high relative humidity (>70% R.H.) due to retarded set times of mortar/adhesives. Replace or restore work of other trades damaged or soiled by work under this section.

PART 4 – HEALTH AND SAFETY

The use of personal protection such as rubber gloves, suitable dust masks, safety glasses and industrial clothing is highly recommended. Discarded packaging, product wash and waste water should be disposed of as per local, state or federal regulations.

All references are the intellectual property of their respective owners:

TCA Handbook for Ceramic Tile Installation. Tile Council of North America, Inc. Anderson, SC,.

American National Standard Specifications for Installation of Ceramic Tile. Tile Council of North America, Inc. Anderson, SC,.

Annual Book of ASTM Standards. American Society for Testing and Materials. West Conshohocken, PA,.

International Building Code, International Code Council. Country Club Hills, IL,.

International Residential Code for One- and Two-Family Dwellings, International Code Council. Country Club Hills, IL,.

LEED NC for New Construction Reference Guide v 2.2. U.S Green Building Council. Washington, D.C.,.

Lightweight Steel Framing Binder. Canadian Sheet Steel Building Institute. Cambridge, ON, Canada.

North American Specification for the Design of Cold-Formed Steel Structural Members. American Iron and Steel Institute. Washington D.C.,.

ICBO ER-4943P Product Technical Information. Steel Stud Manufacturers Association. Chicago, IL.

Steel Framing Systems Manual. Metal Lath Steel Framing Association. Chicago, IL.

END OF SECTION

SECTION 05 1200

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

A. The Work required under this Section consists of structural steel, steel erection, shop painting, field touch-up painting, and related items necessary to complete the Work.

B. Miscellaneous angles, channels, anchor bolts, bent plates, sleeves, sag rods, leveling plates, bearing plates for structural steel and steel joists, and other incidental items of structural steel required to be built into concrete or masonry shall be provided as indicated or specified and be furnished to respective trades at proper time; including instructions and templates for their installation.

1.2 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including nuts and washers.

    a. Include Direct Tension Indicators if used.

3. Structural steel primer paint.
4. Shrinkage-resistant grout.
5. Product data and manufacturers specifications for prime paints as specified.

C. Shop drawings shall be prepared under supervision of a licensed Structural Engineer, in the State in which the Project is located, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.

1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
3. Complete shop drawings by approved fabricator including plan layouts of columns and anchor bolt locations, erection diagrams, and shop detail drawings. Symbols and indications used for structural components on design drawings must appear identically on submitted shop drawings. Types of electrodes proposed for welding processes must also appear thereon.

    a. The fabricator must review and check shop drawings prior to submission to the Architect.

D. Test reports conducted on shop- and field-bolted and welded connections. Include data on type(s) of tests conducted and test results.

E. Certified copies of each survey conducted by a licensed Land Surveyor, showing elevations and locations of base plates and anchor bolts to receive structural steel and final elevations and locations for major members. Indicate discrepancies between actual installation and contract documents.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges."

2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary of the AISC Specification," and the current supplements.
3. AISC "Specifications for Structural Joints using ASTM A325 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
4. AWS "Structural Welding Code," AWS D1.1 and its latest revision.
5. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piping, and Bars for Structural Use."

B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
2. If re-certification of welders is required, re-testing will be Contractor's responsibility.

C. Structural fasteners shall be manufactured in the United States. Fabricator shall furnish proof of U.S. manufacturer to Architect/Engineer. If it becomes necessary to use imported fasteners, each size, type, and each large quantity package (500 pcs. or more) shall undergo a random sampling of a minimum 5 pieces for testing and the test results to be provided to Architect. Test shall be performed by an independent testing agency and the cost shall be included in the Base Bid. If inferior fasteners are discovered, all fasteners of that type shall be removed and replaced with acceptable fasteners at no cost to the Owner. Fasteners shall be tested prior to use in construction.

1.4 WELDING QUALITY CONTROL

A. Welding operators shall be qualified under the provisions of the AWS Structural Welding code, on test pieces in positions and with clearances equivalent to those actually to be encountered in construction. Welders shall make only those type of welds for which they are specifically certified.

B. Welds requiring inspection shall be so indicated in the Drawings.

1. Welds indicated as requiring visual inspection shall be visually inspected by an independent inspector, acceptable to the Architect, pre-qualified to make the weld being inspected. Welders and inspectors shall be pre-qualified by the American Welding Society Qualification Test.

C. The Contractor performing the welding requiring inspection shall cooperate with the independent testing service performing weld testing.

D. Written reports will be submitted for each weld tested and will indicate whether or not weld is acceptable for intended use.

E. If by inspection welds fail to meet minimum acceptable criteria, the welds shall be cut out and replaced.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and re-lubricate before use.

1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 INSPECTION

A. The materials and workmanship to be furnished under this Specification shall be subject to inspection in the mill, shop, and field by the Architect/Engineer. Inspection will be conducted without expense to the Contractor; however, inspection in the mill or shop shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract Documents.

PART 2 PRODUCTS

2.1 ACCEPTABLE FABRICATORS

A. Firms acceptable as fabricators for structural steel Work under this Section shall be members of The American Institute of Steel Construction **(or)** shall be certified by an approved independent professional testing agency as being qualified for Category I Conventional Steel Structures in conformance to the requirements of the AISC Quality Certification Program.

2.2 MATERIALS

A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

B. Rolled Structural Steel Shapes, Plates, and Bars: ASTM A 36.

C. Structural Steel Tubular Products:

1. Square, Rectangular, and Special Shapes: ASTM A500, Grade C.
2. Round, Structural Steel Pipe: ASTM A53, Type E or S, Grade B.

D. Steel Castings: ASTM A 27, Grade 65-35, medium-strength carbon steel.

E. Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel with dimensions complying with AISC Specifications.

F. Anchor Bolts: ASTM F1554 Grade 36 Heavy Hex Head, unless otherwise indicated.

G. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.

1. Provide hexagonal heads and nuts for all connections.
2. Provide either hexagonal or square heads and nuts, except use only hexagonal units for exposed connections.

H. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM A 325. Use 3/4-inch bolts, unless noted otherwise on Drawings. Use bearing type connections with threads included in the shear plane.

   a. Where indicated as galvanized, provide units that are zinc coated, either mechanically deposited complying with ASTM B 695, Class 50, or hot-dip galvanized complying with ASTM A 153.

2. Quenched and tempered alloy steel bolts, nuts, and washers, complying with ASTM A 490.

I. Direct Tension Indicators: ASTM F 959, type as required.

1. Use on all A325 and A490 bolts.
2. Use on all A325 and A490 bolts on connections that are slip critical.
3. Use at Contractor's option.

J. Electrodes and Flux for Submerged Arc Welding: AWS Code and ASTM A588, Series A233, Series E60 or E70 as required.

K. Electrodes and Flux for Submerged Arc Welding: AWS Code and ASTM A588, Series F60 and F70.

L. Structural Steel Primer Paint: Steel Structures Painting Council (SSPC) - Paint 15.

M. Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621-89A.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Sure-Grip High Performance Grout; Dayton Superior.
    b. Euco N.S.; Euclid Chemical Co.
    c. Crystex; L & M Construction Chemicals, Inc.
    d. Masterflow 713; Master Builders.
    e. Sealtight 588 Grout; W. R. Meadows.
    f. Five Star Grout; U.S. Grout Corp.

2.3 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members as shown.

    1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
    2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Connections: Weld or bolt shop connections, as shown.

    1. Bolt field connections, except where welded connections or other connections are indicated.

        a. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
        b. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.

C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts."

D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

    1. Assemble and weld built-up sections by methods that will produce true alignment of axes without warp.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

F. Steel Wall Framing: Select members that are true and straight for fabrication of steel wall framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld steel bar stops to frames, except where shown removable. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches O.C., unless otherwise indicated.

H. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.

I. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.

J. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

K. Expansion Joints: Provide expansion joints in steel shelf angles when part of structural steel frame; locate at vertical brick expansion joints as indicated on Drawings.

2.4 SOURCE QUALITY CONTROL

A. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

1. Promptly notify Architect/Engineer whenever design of members and connections for any portion of structure are not clearly indicated.

PART 3 EXECUTION

3.1 INSPECTION

A. Erector must examine the areas and conditions under which structural steel work is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.

3.2 ERECTION

A. Comply with the AISC Specifications and Code of Standard Practice and with specified requirements.

B. Surveys: Employ a licensed land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Architect.

C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

E. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and rough-in to improve bond to surfaces. Clean the bottom surface of base and bearing plates.

1. Setting Plate Procedure:

a. Set loose and attached base plates and bearing plates for structural members on wedges or other adjustable devices.
b. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
c. Pack bedding grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.

2. Double Nut Procedure

a. Install lower nuts and washers to required elevation.
b. Erect column and install upper nuts and washers.
c. After structure has been erected and plumbed, adjust lower nuts to relieve racking, adjust elevation, and distribute load equally to all anchor bolts.
d. Tighten nuts.
e. Pack bedding grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.

F. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

G. Level and plumb individual members of structure within specified AISC tolerances.

H. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

I. Splice members only where indicated and accepted on shop drawings.

J. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

K. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

L. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide minimum dry film thickness of not less than that specified for the prime paint.

3.3 HIGH STRENGTH STEEL BOLTS

A. Structural joints using high strength bolts, hardened washers, and nuts shall be tightened to a high tension; the materials, methods of installation and tension control, type of wrenches to be used, and inspection methods shall conform to specifications for "Structural Joints using ASTM A325 or A490 Bolts," as approved by the Research Council on Structural Connections of the Engineering Foundation, November 13, 1985.

B. The high strength bolts used shall have a suitable identifying mark placed on top of the head before leaving the factory.

C. Tightening of nuts shall be done by the turn-of-nut method, according to the specifications for "Structural Joints using ASTM A325 or A490 bolts," unless direct tension indicator washers are used, in which case tightening will terminate when proper gap is attained.

D. For turn of the nut method, bolts that have been "Snug-Tight" shall be marked with identifying symbol and then given an additional 1/2 turn. Marks shall be such that visual inspection can be made of finished connections. Snug tight is defined as the tightness developed by the full effort of a man using a spud wrench on all bolts in the connections.

3.4 ERECTION ALIGNMENT

A. Framing: The framing shall be carried up true, plumb, and level within a tolerance of 1:500; and temporary bracing shall be introduced, wherever necessary, to take care of loads to which the structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. It shall finally be removed by the Contractor as part of his equipment. As erection progresses, the Works hall be securely connected to take care of dead load, wind, and erection stresses.

3.5 FIELD QUALITY CONTROL

A. Owner will engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

B. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. Testing agency may inspect structural steel at plant before shipment.

E. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.

F. Shop-Bolted Connections: Inspect or test in accordance with AISC specifications.

    1. Verify that gaps of installed Direct Tension Indicators are less than gaps specified in ASTM F 959, Table 2.

G. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:

    1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
    2. Perform visual inspection of all welds.
    3. Perform tests of welds as follows. Inspection procedures listed are to be used at Contractor's option.

        a. Liquid Penetrant Inspection: ASTM E 165.
        b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
        c. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
        d. Ultrasonic Inspection: ASTM E 164.

H. Field bolted connections shall be tested in accordance with RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts". Frequency in testing shall be one (1) bolt in each connection and if a failure occurs then all bolts in that particular connection shall be tested.

I. Field Welding: Inspect and test during erection of structural steel as follows:

    1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
    2. Perform visual inspection of all welds.
    3. Perform tests of welds as follows:

        a. Liquid Penetrant Inspection: ASTM E 165.
        b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
        c. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
        d. Ultrasonic Inspection: ASTM E 164.

END OF SECTION

SECTION 05 2100

STEEL JOISTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pre-engineered steel joists
2. Bridging
3. Ceiling extensions
4. Bearing plates
5. Side wall anchors
6. Extended ends

1.2 REFERENCES

A. Steel Joist Institute, SJI:

1. Standard Specifications for Open Web Steel Joists, K-Series; and Standard Load Table, Open Web Steel Joists, K-Series.
2. Standard Specifications for Longspan Steel Joists LH Series; and Standard Load Table, Longspan Steel Joists, LH Series.
3. Standard Specifications for Deep Longspan Steel Joists, DLH Series; and Standard Load Table, Deep Longspan Steel Joists, DLH Series.
4. Standard Specifications for Joist Girders.
5. Recommended Code of Standard Practice for Steel Joists and Joist Girders.

B. American Society for Testing and Materials:

1. ASTM A36, Standard Specification for Structural Steel.
2. ASTM A307, Standard Specification for Carbon Steel Externally Threaded Standard Fasteners.

C. American Welding Society:

1. AWS A5.5, Specification for Steel, Low-Alloy, Covered Arc Welding Electrodes.
2. AWS D1.1, Structural Welding Code - Steel.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop and erection drawings to include member marks, number, type, location, and spacing of members; details of bridging, extended ends and attachment at supports.

1. Reproduction of Contract Drawings shall not be used for drawings.

B. Design: Indicate on shop drawings where special designs have been provided, including a detailed, written description of magnitudes and locations of loads for each special design loading condition.

C. Submit Certified mill test reports showing compliance with requirements of ASTM and SJI Specifications.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Member of Steel Joist Institute
2. Fabrications, handling, erection and connections of steel joists shall be in accordance with latest editions of SJI Specifications.

B. Welding Operator Qualifications:

1. Certified within 6 months previous

1.5 DELIVERY, STORAGE AND HANDLING

A. Mark pieces for identification during erection.

B. Deliver to site in proper sequence for erection.

C. Store materials above ground; prevent corrosion, warpage and twisting.

D. Do not bend or damage members during handling.

E. Take precautions breaking bundles to prevent damage to materials and injury to workmen.

1.6 DESIGN

A. Joists shall be designed by the fabricator in accordance with the specifications of the Steel Joist Institute.

B. Where loads are shown or specified, members shall be designed for the specific loading conditions required.

C. Where loadings are not shown, members shall be designed for the maximum allowable load indicated in the standard load tables published by the Steel Joist Institute for the member designation and spans required.

D. Fabricator shall determine and include in the work any and all special bridging or temporary bracing required for proper erection or final assembly of the work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel bridging, bearing plates and wall anchors: comply with ASTM A36.

B. Bolts: comply with ASTM A307.

C. Welding Electrodes: comply with AWS A5.5, E70 or submerged arc Grade SAW-2.

D. Steel Joists: comply with SJI Specifications.

1. Provide double angle bottom chords.
2. Provide extended ends where required.

E. Paint: rust-inhibiting primer; comply with SJI Specifications; paint and methods of paint application shall comply with applicable air-quality and environmental regulations.

2.2 FABRICATION

A. Design and fabricate joists in accordance with SJI Specifications.

B. Accessories: Provide required sag rods, bridging, extended bottom chords and top chords, side wall anchors, wall connectors, headers, and ceiling extensions.

C. Shop Paint: After fabrication, clean joists, bridging, and anchors of rust, mill scale, dirt and other foreign material. Remove grease and oil with solvents. Apply one coat of paint, minimum thickness of 1 mil.

1. Paint coat for steel exposed in crawl space not less than 3.0 mils thick.

D. Extended Ends: Design to cantilever from the main span of the joist, provide load capacity at least equal to that of joist.

E. Provide horizontal and X-bridging as required, minimum bridging requirements in accordance with SJI Specifications.

2.3 SOURCE QUALITY CONTROL

A. Laboratory Testing and Inspection

1. Inspect fabricating and welding procedures in shop.

2. Visually inspect shop welds.
3. Inspect painting procedures.
4. Check material certifications in shop.

PART 3 EXECUTION

3.1 ERECTION

A. Replace joists damaged by bending or warping during handling and erection.

B. Bridging shall comply with SJI Specifications and with details on Drawings.

C. Minimum bearing and anchorage shall comply with SJI Specifications and Drawings as related to particular type of support.

D. Provide erection bolts for joists located on column centerlines.

E. Set joists to lines, levels, and spacing as indicated. Provide bearing plates as indicated or required to carry out structural requirements. Execute general handling and erection in accordance with SJI Specifications.

F. Permanently fasten joists to supports and install bridging and anchorage before any construction loads, other than workmen, are placed on joists.

G. Perform welding in accordance with AWS D1.1.

H. Properly store and protect electrodes to prevent deterioration or damage by moisture and climate.

I. After erection, touch up field connections and abraded places of shop paint with same kind of paint as shop coat.

J. Do not weld bottom chords of joists to supports until full dead load of roof is applied. Brace joists and supporting structure for safety and stability until permanent bracing structures are in place.

K. Do not use bridging to support conduit, piping, duct work, or other equipment.

L. Do not attach hangers supporting loads in excess of 100 pounds directly to joist chords. See details on Structural Drawings for methods of supporting loads in excess of 100 pounds on joists.

3.2 ADJUSTING

A. Touch-up abrasions and welds with shop paint.

B. Joists in crawl space: paint all connections with Special Paint.

C. Correct or replace damaged materials at no additional cost to the Owner.

3.3 FIELD QUALITY CONTROL

A. Laboratory Testing and Inspection

1. Inspect condition of materials after erection.
2. Inspect connections to supporting structure.

END OF SECTION

SECTION 05 3123

METAL ROOF DECK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal Roof Deck
2. Sheet Metal Accessories

1.2 REFERENCES (Latest Edition Available)

A. Steel Deck Institute (SDI), Specifications and Commentary for Steel Roof Deck.

B. American Iron and Steel Institute (AISI), Specification for the Design of Cold-Formed Steel Structural Members.

C. American Welding Society:

1. AWS A5.1, Specification for Steel, Carbon, Covered Arc Welding Electrodes.
2. AWS D1.3, Structural Welding Code - Sheet Steel.

D. American Society for Testing and Materials:

1. ASTM A90, Standard Tests for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
2. ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
4. ASTM A1008, Standard Specification for Steel Sheet, Cold-Rolled Sheet, Carbon, Structural.
5. ASTM B117, Standard Salt Spray (Fog) Test.
6. ASTM D714, Evaluating Degree of Blistering of Paints.
7. ASTM D1654, Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

E. Underwriters Laboratories, Inc.:

1. Bulletin of Research No. 52, Development of Apparatus and Test Method for Determining Wind Uplift Resistance of Roof Assemblies.
2. Standard UL580, Tests for Wind Uplift Resistance of Roof Assemblies.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings for review prior to fabrication or installation of materials.

1. Indicate erection layouts, details, steel deck dimensions and section properties, and installation instructions. Show supporting framing, lengths and markings of deck to correspond with sequence and procedure to be followed in installing and fastening deck. Show methods of fastening deck and installing accessories. Show locations, types and sequence of welded connections for deck units.
2. Indicate welds using standard AWS welding symbols. Show size and number of holes to be cut in deck.
3. Indicate allowable diaphragm shear capacity corresponding to pattern and type of connections provided.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications

1. Member Steel Deck Institute.
2. Minimum 5 years of experience.

B. Erector Qualifications

1. Minimum 5 years of experience.
2. Welders certified within previous 6 months.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver deck in bundles and store on pallets above the ground, protect from corrosion and damage. Rusted, crimped or bent deck shall not be installed in the work.

B. Do not store materials on installed deck before connecting to supporting structure.

C. Do not overload deck during construction by workmen or storage of materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Grades:

1. ASTM A1008, Grade C for painted deck.
2. ASTM A653, Grade A for galvanized deck.

B. Miscellaneous steel plates at vents, sump pans, and closures: 20 gage material.

C. Welding Rods: AWS A5.1, E70

D. Weld Washers: 14 gage, with 3/8ths diameter hole at center.

E. Galvanizing:

1. Wiped zinc coating, 0.2 to 0.5 ounces per square foot, complying with ASTM A924.
2. Comply with ASTM A90 and A239 for weight and uniformity.

F. Paint:

1. Resistant to solvents used to clean deck.
2. Resistant to solvents in foamed-in-place insulation.
3. Resistant to corrosion and blistering in accordance with ASTM B117, D714 and D1654.

2.2 MANUFACTURED UNITS

A. Metal deck units shall comply with the Specifications of the Steel Deck Institute.

B. Design units for required spans and conditions of continuity, generally for 3 continuous spans, except as required by layout.

C. Stresses under construction loads, gravity loads and wind loading shall not exceed recommendations of the Steel Deck Institute.

2.3 FABRICATION

A. Fabricate in lengths as long as practical and piece-mark bundles for identification during erection.

B. Painting:

1. Thoroughly clean deck and coat both sides with phosphate prior to painting.
2. Apply paint .30 mils minimum thickness to both sides of deck and heat cure for tough, abrasion-resistant finish.

PART 3 EXECUTION

3.1 INSTALLATION

A. Do not lay deck units in place until supporting structure is secured in place and final connections are complete.

B. Layout deck units in accordance with shop drawings, do not stretch or bend units.

C. Overlap ends a minimum of 2 inches. Interlock side laps as shown on shop drawings.

D. Connections:

1. Anchor deck to supporting steel with full-fusion puddle welds. Use weld washers where required.
2. Connect side laps with screws or welds.
3. Side lap connections of interlocking edges shall be made by button-punching with a specially designed crimping tool.

E. Weld metal fillers and closure pieces in place.

3.2 FIELD QUALITY CONTROL

A. Laboratory Testing and Inspection:

1. Inspect condition of deck units for damage and corrosion.
2. Inspect connections of deck to structure and at side laps.

3.3 ADJUSTING

A. Touch-up scarred areas on both sides of deck including welds, rust spots and abrasions by wire-brushing and painting with shop paint.

B. Repair blow-holes at welds with 18 gage plates welded in place. Replace entire sections of deck where holes cannot be satisfactorily repaired.

3.4 HANGERS FOR MISCELLANEOUS EQUIPMENT

A. Do not attach hangers for ceilings, ductwork, or piping directly to metal roof deck.

END OF SECTION

SECTION 05 40 00

COLD – FORMED METAL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior and interior bearing steel-stud curtainwall.

1.3 PERFORMANCE REQUIREMENTS

A. AISI "Specifications": Calculate structural characteristics of cold-formed metal framing according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and the following:

B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the following minimum physical and structural properties:

1. Physical and Structural Properties: As indicated on the drawings.

C. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.

1. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 deg F.

1.4 SUBMITTALS

A. Shop drawings showing layout, spacings, sizes, thicknesses, and types of cold-formed metal framing, fabrication, fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachments to other units of Work.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Alabama Metal Industries Corp.
2. American Studco, Inc.
3. Angeles Metal Systems.
4. California Metal Systems, Inc.
5. Clark-Cincinnati, Inc.
6. Consolidated Fabricators Corp.
7. Consolidated Systems, Inc.
8. Dale//Incor Industries of Florida.
9. Dale Industries, Inc.
10. Design Shapes in Steel.
11. Dietrich Industries, Inc.
12. Incor Plant Dale Industries.
13. Knorr Steel Framing Systems.
14. MarinoWare; Div. of Ware Industries, Inc.
15. Studco of Hawaii, Inc.
16. Super Stud Building Products, Inc.
17. Unimast, Inc.
18. United Construction Supply.
19. United States Steel.
20. Western Metal Lath Co.

2.2 MATERIALS

A. Galvanized-Steel Sheet: ASTM A 446, zinc coated according to ASTM A 525, and as follows:

1. Coating Designation: G 60 (Z 180).
2. Grade: Grade A, 33,000 psi minimum yield strength, 20 percent elongation.

2.3 WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depths indicated, with lipped flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: see drawings.
2. Flange Width: see drawings.
3. Web: Punched.

B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:

1. Design Uncoated-Steel Thickness: See structural drawings for excat sizes.
2. Flange Width: Manufacturers standard deep flange where indicated, standard flange elsewhere. See structural drawings for exact sizes.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36, zinc coated by the hot-dip process according to ASTM A 123.

B. Cast-in-Place Anchor Bolts and Studs: ASTM A 307, Grade A; carbon-steel hex-head bolts and studs; carbon-steel nuts; and flat, unhardened-steel washers. Zinc coated by the hot-dip process according to ASTM A 153.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency. These anchors can only be used with the approval of the Engineering of Record.

D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

1. Fabricate framing assemblies in jig templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted.
4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to manufacturer's recommendations.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.

C. Fabrication Tolerances: Fabricate assemblies to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements, including installation tolerances and other conditions affecting performance of cold-formed metal framing. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel stud bearing surfaces must be smooth, uniform and level, if not grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

1. Concrete foundation must be smooth and level. Any irregularities must be removed before installation of the bottom track for all walls.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

C. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

D. Provide temporary bracing and leave in place until framing is permanently stabilized.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and double studs, inaccessible upon completion of framing work.

G. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 NONLOAD-BEARING CURTAINWALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches or as shown on the drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate steel framing from building structure at locations indicated to prevent transfer of vertical loads while providing lateral support.

1. Install deflection track and anchor to building structure.
2. Connect studs with vertical slide clips to continuous angles or supplementary framing anchored to building structure.

E. Install horizontal bridging in curtainwall studs, spaced in rows not more than 48 inches apart. Fasten at each stud intersection, see drawings.

1. Install additional row of horizontal bridging in curtainwall stud beneath deflection track when curtainwall studs are not fastened to an additional top track.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtainwall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform field quality-control testing. See Structural Drawing Sheet S-002 for Qualigy Assurance requirements.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work that does not comply with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTM A 780 and the manufacturer's instructions.

END OF SECTION 05 40 00

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel ladders.
2. Loose bearing and leveling plates.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.

B. Related Sections include the following:

1. Concrete Forming and Accessories:	Section 03 1000
2. Structural Steel:	Section 05 1200
3. Painting	Section 09 9000

1.3 SUBMITTALS

A. Product Data: For the following:

1. Miscellaneous metal fabrications.
2. Paint products.

B. Shop Drawings: Detail fabrication and erection of each miscellaneous metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

C. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2.3 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

2.4 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).

G. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

H. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

2.5 GROUT

A. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.7 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, unless otherwise indicated.

B. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.

C. Bar Rungs: 3/4-inch-diameter steel bars, spaced 12 inches O.C.

D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

E. Support each ladder at top and bottom and not more than 60 inches O.C. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

F. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

2.8 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 SETTING BEARING AND LEVELING PLATES:

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use non-shrink grout, nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING:

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 055113

METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs and railings.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings so wall attachments are made only to completed walls.

1. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Prefilled metal-pan-stair treads.
2. Abrasive nosings.
3. Shop primer products.
4. Handrail wall brackets.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall- mounted handrails.

C. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated- design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
   a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the

following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

   a. Uniform load of 50 lbf/ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

   a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

4. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

   a. Component Importance Factor: 1.5.

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing for Railings: ASTM A 500/A 500M (cold formed) or ASTM A 513/A 513M.

D. Steel Pipe for Railings: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

2.3 ABRASIVE NOSINGS

A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Safety Tread Co., Inc.
b. Amstep Products.
c. Armstrong Products, Inc.
d. Balco, Inc.
e. Granite State Casting Co.
f. Nystrom, Inc.
g. Upnovr, Inc.
h. Wooster Products Inc.

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Nosings: Square-back units, 3 inches wide, without lip.
4. Nosings: Two-piece units, 3 inches wide, with subchannel for casting into concrete.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.4 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Wall Brackets: Cast nickel-silver, aluminum, bronze, or stainless steel, center of rail 3-1/8 inches from face of wall.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering

products that may be incorporated into the Work include, but are not limited to, the following:

a. Blum, Julius & Co., Inc.
b. The Wagner Companies., R&B Wagner, Inc.

B. Welding Electrodes: Comply with AWS requirements.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

D. Prefilled Concrete Treads:

1. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs and railings in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for:

a. Building Stair: Finish #1 - No evidence of welded joint, as shown in NAAMM AMP 521.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.7 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for:

1. Architectural Class for Building Stairs.

B. Stair Framing:

1. At Building Stairs, fabricate stringers of steel rectangular tubes.

a. Stringer Size: As required to comply with "Performance Requirements" Article.
b. Provide closures for exposed ends of channel and rectangular tube stringers.
c. Finish: Shop primed.

2. Construct platforms of steel plate, channel, or rectangular tube headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

a. Provide closures for exposed ends of channel and rectangular tube framing.
b. Finish: Shop primed.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Steel Sheet: Uncoated, cold-rolled steel sheet for interior applications Building Stair).
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Shape metal pans to include nosing integral with riser.
4. Attach abrasive nosings to risers of stairs in stairwell.
5. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
6. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits at Building Stairs.

2.8 FABRICATION OF STAIR RAILINGS

A. Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing,

and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-5/8-inch diameter top and bottom rails and posts.
2. Picket Infill at Building Stairs: 1/2-inch to 3/4-inch round or square pickets spaced less than 4 inches clear.

B. Welded Connections: Fabricate railings with welded connections.

1. Cope components at connections to provide close fit, or use fittings designed for this purpose.
2. Weld all around at connections, including at fittings.
3. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
4. Obtain fusion without undercut or overlap.
5. Remove flux immediately.
6. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for:

a. At Building Stairs: Finish #1 - No evidence of welded joint as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:

1. By bending or by inserting prefabricated elbow fittings.
2. By flush bends or by inserting prefabricated flush-elbow fittings.
3. By radius bends.
4. By inserting prefabricated elbow fittings.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
3. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.9 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

1. Grouted Baseplates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.

a. Clean bottom surface of plates.
b. Set plates for structural members on wedges, shims, or setting nuts.
c. Tighten anchor bolts after supported members have been positioned and plumbed.
d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.
2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

E. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.
2. Center nosings on tread width.

3.3 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts and rail ends to building construction as follows:

a. Anchor posts to steel by welding or bolting to steel supporting members.
b. Anchor handrail ends to masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets.

1. Locate brackets at spacing required to support structural loads.
2. Secure wall brackets to building construction as required to comply with performance requirements, or as follows:

a. For hollow masonry anchorage, use toggle bolts.

3.4 REPAIR

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

END OF SECTION 055113

SECTION 05 73 00
ORNAMENTAL RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ornamental stainless steel cable railing system. (Rainier)

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

1.3 REFERENCES

A. ASTM International (ASTM):
   1. ASTM A 554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
   2. ASTM A 492 - Standard Specification for Stainless Steel Rope Wire.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's specifications and technical data including the following:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.

C. Shop Drawings: Submit shop drawings for fabrication and installation. Include the following:
   1. Plans, elevations, and detail sections.
   2. Indicate materials, methods, finishes, and types of joinery, fasteners, anchorages, and accessory items.
   3. Where materials or fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis.

D. Samples: Prepare samples on metal of same alloy and thickness to be used for the Work.

E. Quality Control Submittals: Statement of manufacturer's qualifications.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than 10 years experience in the actual production of specified products.

B. Installer's Qualifications: Firm with demonstrated experience in installation of systems similar in complexity to those required for this Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.

B. Store materials in manufacturer's original sealed, labeled packaging until ready for installation and in accordance with manufacturer's instructions. Protect from damage.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits

recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard 3 year limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: AGS Stainless, Inc., Attn: Diana Boghokian, which is located at: 7873 N. E. Day Rd.; Bainbridge Island, WA 98110; Tel: 206-707-0414; Fax: 206-842-8179 ; Email:diana@agsstainless.com; Web:http://www.agsstainless.com

B. Requests for substitutions will be considered in accordance with the provisions of Section 01 60 00 - Product Requirements.

2.2 SYSTEM DESCRIPTION - GENERAL

A. Shop fabricate such that no jobsite welding, grinding or cutting is required.

2.3 STAINLESS STEEL RAILING SYSTEMS

A. Stainless Steel Railing System: Clearview Railing System as manufactured by AGS Stainless, Inc.
   1. Type: Rainier - Cable railing.
   2. Fabrication: Factory welded components. Verify dimensions on site prior to shop fabrication.
      a. Mill joints to a tight, hairline fit.
      b. Miter corner joints.
   3. Structural Requirements: Fabricate integral railings and component connections to meet or exceed the requirements as set forth in the current, adopted ICC International Building Code (IBC), International Residential Code (IRC), or governing local code as applicable.

B. Posts:
   1. Post Material: ASTM A 554, Type A316 stainless steel, minimum Fy=40 ksi.
   2. Post Size: 1-1/2 inch (38.1 mm) x 1-1/2 inch (38.1 mm).
   3. Post Mounting Configuration: Top mount, as indicated on installation Drawings.
   4. Post Mounting Configuration: As indicated on Drawings.

C. Top Rails:
   1. Top Rail Material: ASTM A 554, Type A316 stainless steel, minimum Fy=40 ksi.
   2. Top Rail Shape, Size: Round, 1-5/8 inch (15.8 mm) diameter x 16 gauge tubing.

D. Infill - Cables:
   1. Material: ASTM A 492, stainless steel, Type 316.
   2. Construction: 1 x 19.
   3. Diameter: 1/8 inch (3 mm) diameter.
   4. Lay: Left Hand Lang's.
   5. Core: Stainless steel.
   6. Cable Fitting Materials: Stainless steel, Type 316.

E. Hardware: Stainless steel construction; separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

B. Do not proceed with installation until substrates have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install railing system plumb, level, and true and in accordance with manufacturer's installation instructions and recommendations.

B. Do not tighten the cables more than what is necessary to eliminate any sag.

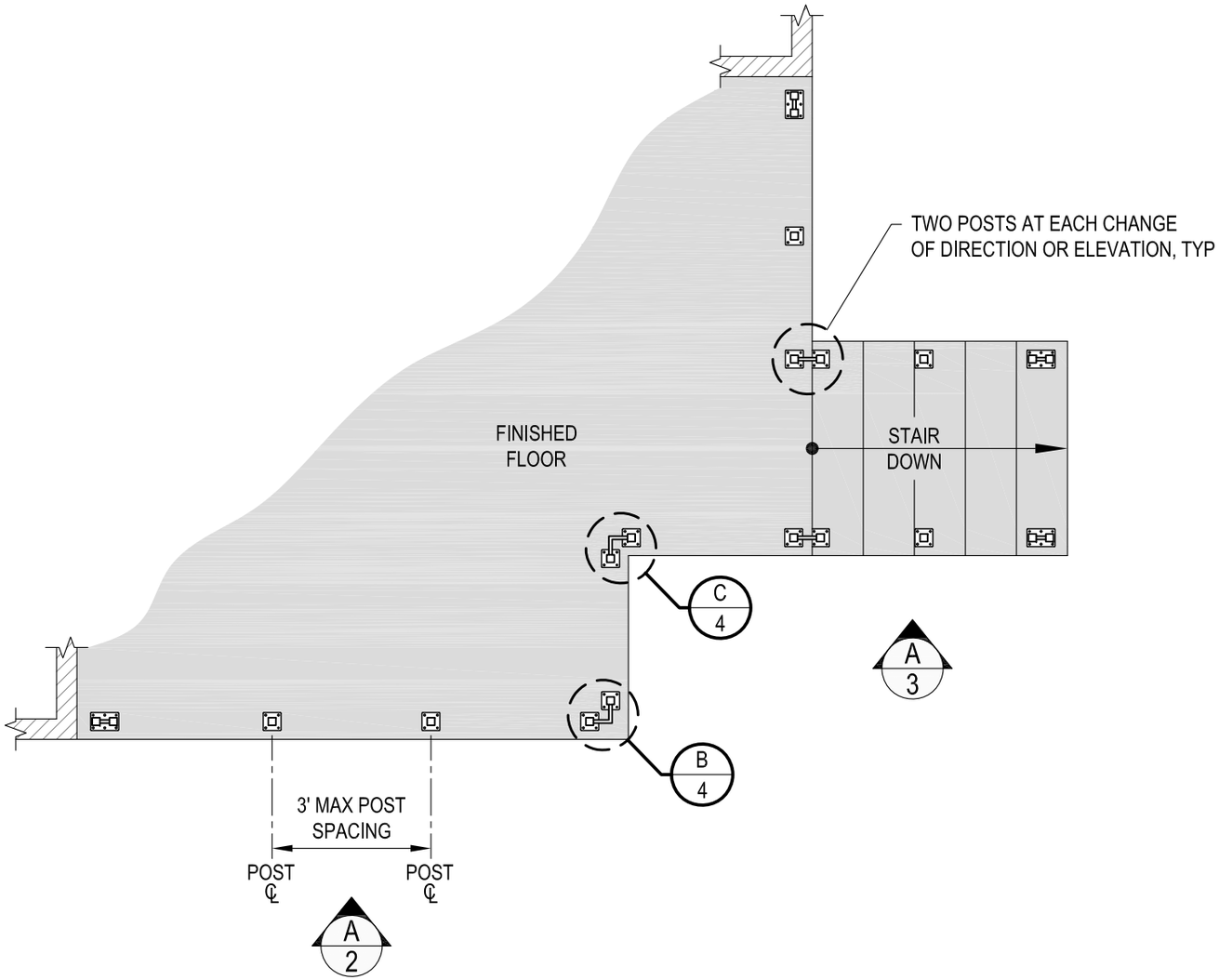
C. Provide anchorage devices and fittings to secure to in-place construction to adjacent construction. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

D. Do not cut components, except for cable as required for installation, or abrade component finishes. Field touch-up of finishes only acceptable if done as per manufacturer's recommendations. Return components with damaged finishes to shop for required alterations according to manufacturer's return policy, followed by complete refinishing or provide new components.

E. Secure mounting brackets to building structure in a positive manner using manufacturer recommended reinforcement and anchorage methods for substrate conditions. Locate brackets and hardware at spacing required to support structural loads.

F. Installation of railing system shall be rigid and secure, installed by mechanics experienced in erection of architectural metal. Mounting hardware shall be drawn up tightly. Rails shall be set plumb and aligned.

END OF SECTION

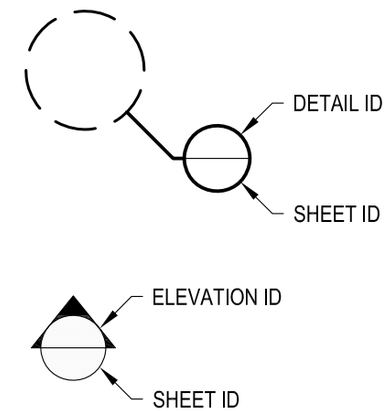


1 EXAMPLE POST LAYOUT
PLAN VIEW

NOTES:

1. TOP RAIL NOT SHOWN FOR CLARITY.
2. ALL PARTS AND COMPONENTS MADE WITH 316 STAINLESS STEEL UNLESS NOTED OTHERWISE.

LEGEND



SIDE MOUNT POST

SIDE MOUNT DOUBLE POST

℄ CENTERLINE

F.F. FINISHED FLOOR

TYP TYPICAL CONDITION APPLIES ELSEWHERE AT SIMILAR CONDITIONS

AGS Stainless Clearview® Railing Systems are designed to meet the requirements of the latest edition of the IRC/IBC.

DWG #	RAINIER TM42RC
SCALE	NONE
DATE	2024
DESIGNER	AGS
SHEET	1 OF 4

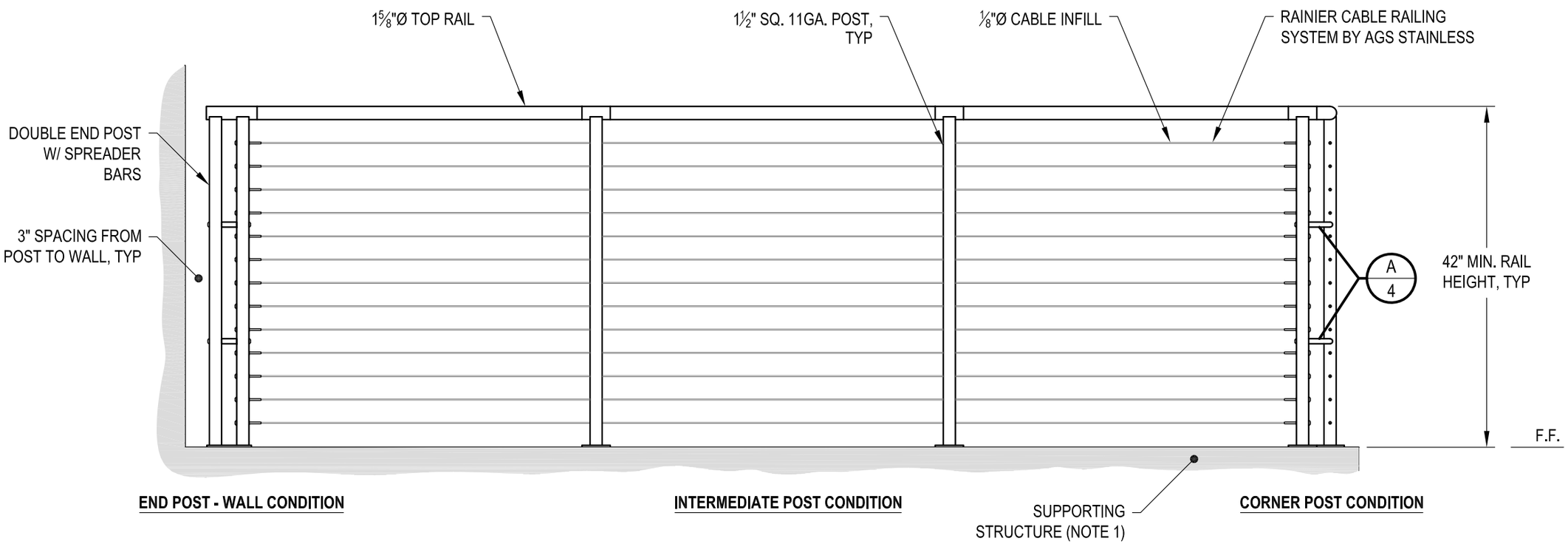
RAINIER SPECIFICATION DRAWING
** COMMERCIAL **
42" TOP MOUNT - ROUND TOP

7873 NE DAY ROAD
BAINBRIDGE ISLAND, WA 98110
PHONE - (888) 842-9492
FAX - (206) 842-8179
WWW.AGSSTAINLESS.COM

AGS stainless LLC
CLEARVIEW® Railing Systems

NOTES:

1. DECK STRUCTURE CAN VARY GREATLY. IT IS THE RESPONSIBILITY OF THE CUSTOMER TO VERIFY THAT THE SUPPORTING STRUCTURE IS ADEQUATE TO MEET THE LOAD REQUIREMENTS OF THE GOVERNING BUILDING CODE(S). *AGS Stainless Inc.* RECOMMENDS CONSULTING A DESIGN OR CONSTRUCTION PROFESSIONAL TO ADDRESS THESE ISSUES.



A — TYPICAL RAILING CONDITION ELEVATION

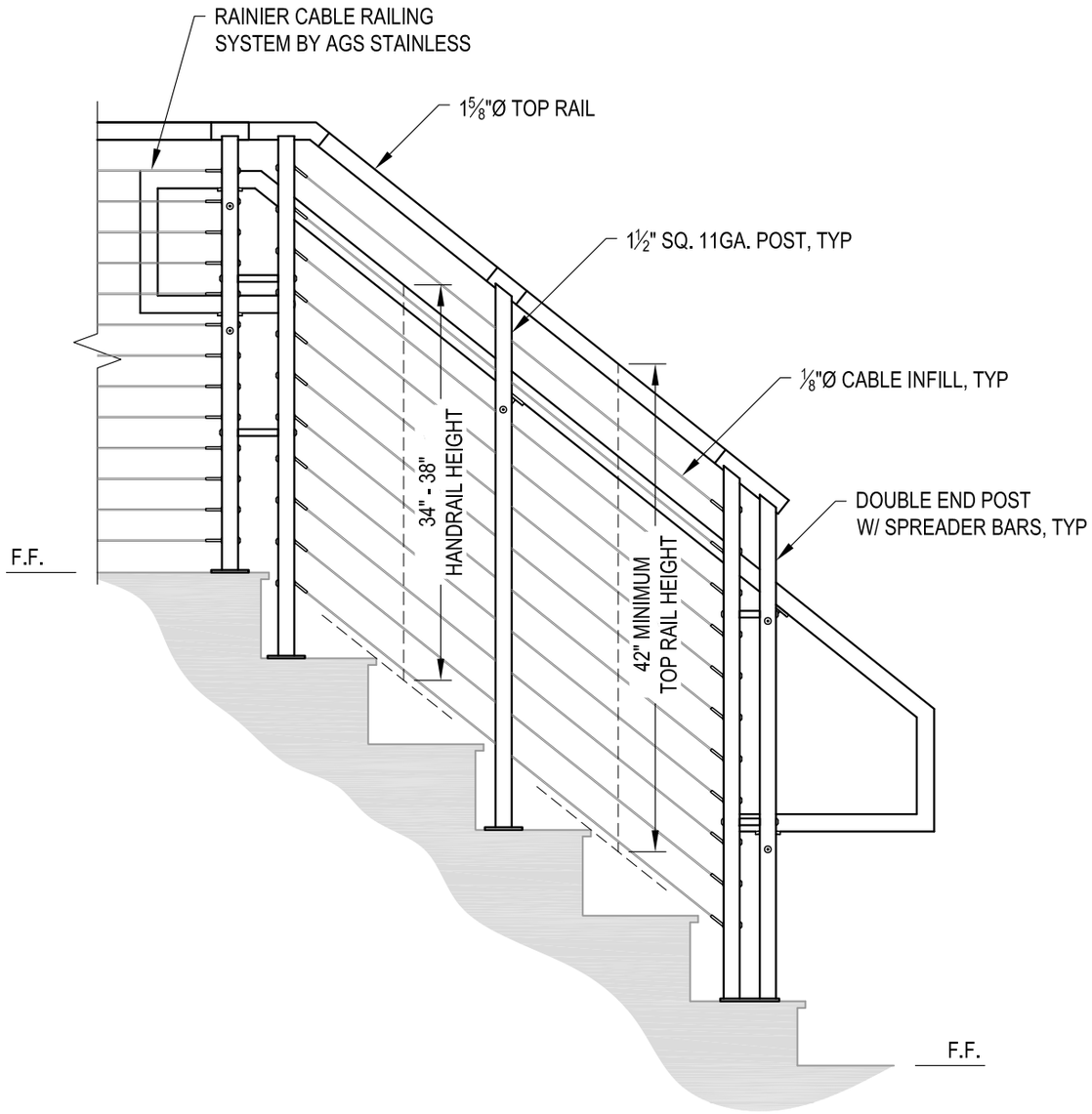
AGS Stainless Clearview® Railing Systems are designed to meet the requirements of the latest edition of the IRC/IBC.

DWG #	RAINIER TM42RC
SCALE	NONE
DATE	2024
DESIGNER	AGS
SHEET	2 OF 4

RAINIER SPECIFICATION DRAWING
** COMMERCIAL **
42" TOP MOUNT - ROUND TOP

7873 NE DAY ROAD
BAINBRIDGE ISLAND, WA 98110
PHONE - (888) 842-9492
FAX - (206) 842-8179
WWW.AGSSTAINLESS.COM

AGS stainless CLEARVIEW® Railing Systems



A STAIR ELEVATION

NOTES:

1. STAIR CONSTRUCTION VARIES GREATLY. AS-BUILT CONDITIONS MAY ALTER RAILING DESIGN, INCLUDING POST LOCATION & MOUNTING, INFILL SPACING & TOP RAIL LAYOUT.

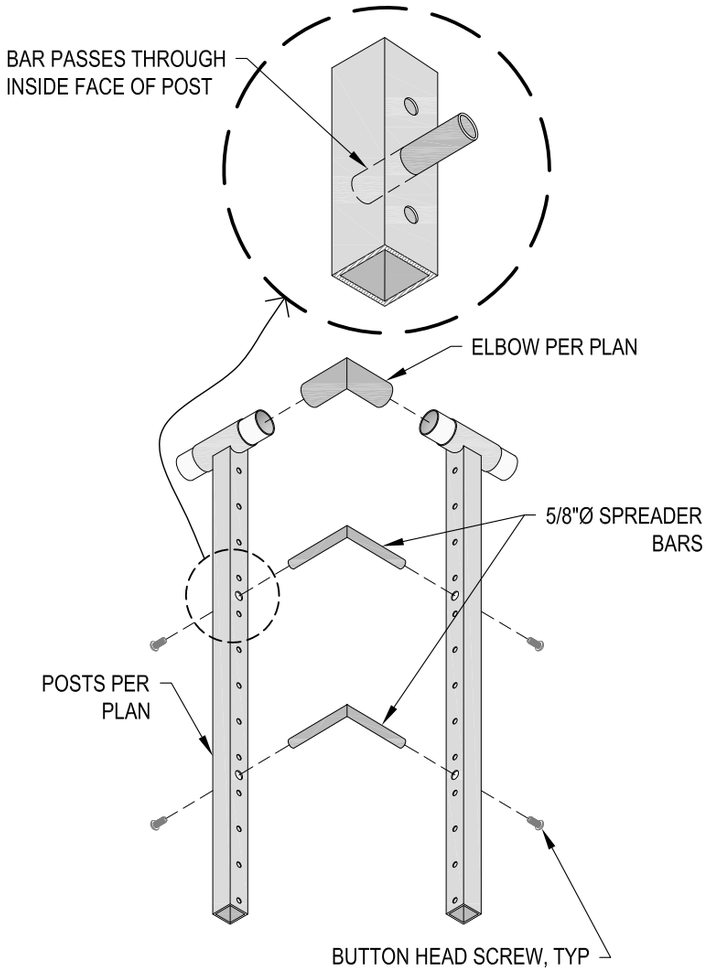
AGS Stainless Clearview® Railing Systems are designed to meet the requirements of the latest edition of the IRC/IBC.

DWG #	RAINIER TM42RC
SCALE	NONE
DATE	2024
DESIGNER	AGS
SHEET	3 OF 4

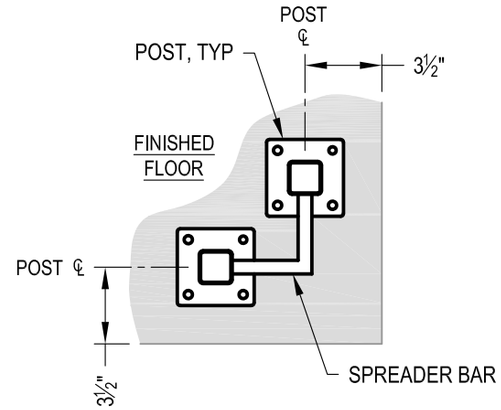
RAINIER SPECIFICATION DRAWING
** COMMERCIAL **
42" TOP MOUNT - ROUND TOP

7873 NE DAY ROAD
BAINBRIDGE ISLAND, WA 98110
PHONE - (888) 842-9492
FAX - (206) 842-8179
WWW.AGSSTAINLESS.COM

AGS stainless LLC
CLEARVIEW® Railing Systems

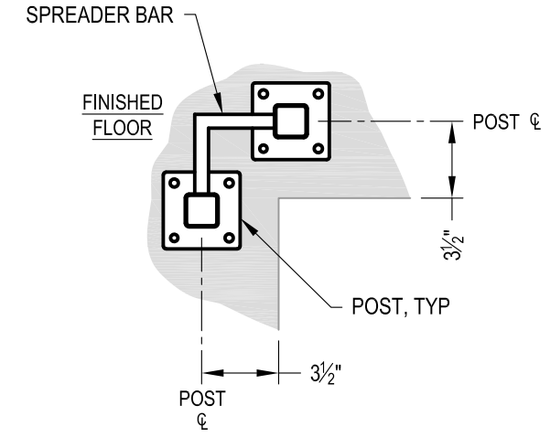


A CORNER POST ASSEMBLY DETAIL



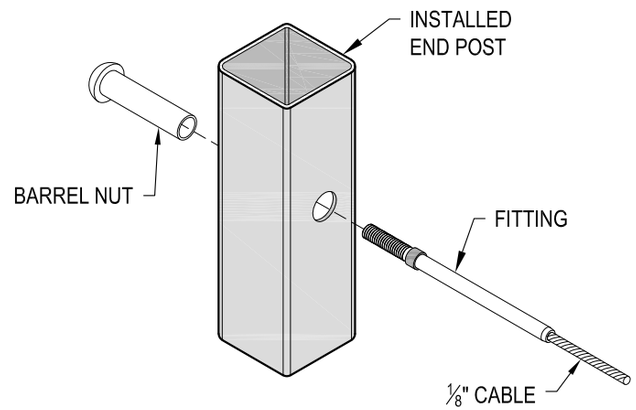
NOTE: 90° SHOWN, OTHER ANGLES SIMILAR

B TYPICAL SIDE MOUNT OUTSIDE CORNER DETAIL

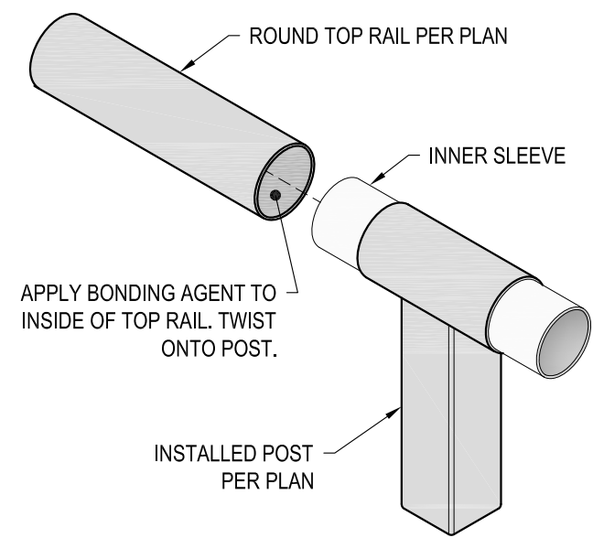


NOTE: 90° SHOWN, OTHER ANGLES SIMILAR

C TYPICAL SIDE MOUNT INSIDE CORNER DETAIL



D FITTING INSTALLATION - BARREL NUT DETAIL



E TOP RAIL INSTALLATION - ROUND DETAIL

AGS Stainless Clearview® Railing Systems are designed to meet the requirements of the latest edition of the IRC/IBC.

DWG #	RAINIER TM42RC
SCALE	NONE
DATE	2024
DESIGNER	AGS
SHEET	4 OF 4

RAINIER SPECIFICATION DRAWING
** COMMERCIAL **

42" TOP MOUNT - ROUND TOP

7873 NE DAY ROAD
BAINBRIDGE ISLAND, WA 98110
PHONE - (888) 842-9492
FAX - (206) 842-8179
WWW.AGSSTAINLESS.COM

AGS stainless LLC
CLEARVIEW® Railing Systems

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wood blocking and nailers, wood furring and grounds, and plywood backing panels.

B. Related Sections:
   1. Section 06 40 00 - Architectural Woodwork.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data:
   1. Include all data for rough carpentry products required for installation.
   2. Fire-retardant-treated wood product data, including certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

C. Warranty: Provide warranty of chemical treatment manufacturer for each type of treatment.

D. LEED Submittals:
   1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
   2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
   3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
   4. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
   5. Product Data: For installation adhesives, indicating VOC content.
   6. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low- emitting materials.

1.3 QUALITY ASSURANCE

A. Lumber Grading: Lumber Grading Rules and Wood Species in accordance with Voluntary Product Standards. Grading rules of following associations apply to materials furnished.
   1. Southern Pine Inspection Bureau (SPIB).
   2. West Coast Lumber Inspection Bureau (WCLIBB).
   3. Western Wood Products Association (WWPA).

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC- accredited certification body.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

D. Grade Marks: Identify lumber and plywood by official grade mark.
   1. Lumber: Include symbol of grading agency, mill name, grade, species, grading rules and condition of seasoning at time of manufacturer.
   2. Plywood: Include type, span rating or group number, exposure durability classification, and agency mark of APA.

1.4 QUALIFICATIONS

A. Design structural site fabricated items under direct supervision of a professional structural engineer experienced in design of this work and licensed in the State of New Mexico.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Store products above ground, on platforms or skids, and covered with waterproof coverings. Provide for adequate air circulation.

C. Do not store seasoned materials in damp or wet locations.

D. Support products in such a way as to prevent warping and distortion.

1.6 WARRANTY

A. Provide a 20-year warranty for each type of chemical treatment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood: Lumber for framing and general carpentry work shall be sound, well manufactured, surfaced S4S material with a moisture content limit of 19%.
   1. Dimension: SPIB grade marked No.2 Dimension Southern Pine or WCLB grade marked No. 2 Dimension Douglas Fir.
   2. Boards: SPIB grade marked No. 2 Boards Southern Pine.
   3. Redwood: RIS grade marked Construction Heart California Redwood.

B. Plywood: Plywood for general carpentry work shall be APA trademarked, 23/32" minimum thickness, Tongue & Groove.
   1. Interior: B - D, Group 2, Exposure 1, fire-retardant treated.
   2. Exterior: C - C plugged grade, Group 2, Exterior type, fire-retardant treated.

C. Engineered Wood Products: Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

D. Rough Hardware:
   1. Anchors, bolts, screws, and spikes shall be of proper types and sizes to support the work, to draw the members into place, and to hold them securely. Bolt heads and nuts bearing on wood shall have standard washers.
   2. Metal fasteners to secure wood grounds and blocking to masonry and concrete shall be of the type best suited to the conditions and spaced no more than 16" o.c. Wood plugs and nailing blocks are not acceptable.
   3. Nails shall be of the sizes and types intended for the particular use.
   4. Rough hardware exposed to the weather or embedded in exterior masonry and concrete walls or slabs shall be galvanized.
   5. Nails and bolts used with preservative treated lumber shall be galvanized.

2.2 WOOD TREATMENT

A. Preservative Treatment:

1. Comply with applicable requirements of AWPA U1; Category UC2 for interior construction not in contact with ground, Category UC3b for exterior construction not in contact with ground, and Category UC4a for items in contact with ground.
   a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
   b. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
2. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19% for lumber and 15% for plywood. Do not use material that is warped or that does not comply with requirements for untreated material
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

B. Fire-Retardant Treatment:
1. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
2. Wood shall be fire-retardant chemically treated and pressure impregnated; with a flame spread index of 25 or less and a smoke development of 0-450 when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
3. Treatment shall not promote corrosion of metal fasteners.
4. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant- treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
5. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
6. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841
7. Kiln-dry lumber and plywood after treatment to maximum moisture content of 19% for lumber and 15% for plywood.
8. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying; discard damaged or defective pieces.

2.3 MISCELLANEOUS MATERIALS

A. Adhesives shall have a VOC content of 70 g/L or less.

B. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
1. Discard units of material with defects which might impair quality of work, and units which are

too small to fabricate work with minimum joints or optimum joint arrangement.

2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Scribe and cope as required.
3. Securely attach carpentry work to substrates by anchoring and fastening as required by recognized standards and as required to draw members into place and securely hold same unless otherwise indicated. Use washers under all bolt heads.
4. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials.
5. Make tight connections between members to develop full strength of members.
6. Install fasteners without splitting of wood.
7. Pre-drill as necessary.
8. Comply with APA E30 requirements for plywood.
9. Install fasteners at spacings recommended by AFPA National Design Specifications for Stress Grade Lumber and Its Fastening - 1973 for lumber and APA Guide E30 for Plywood, unless more restrictive code requirements dictate tighter spacing or heavier fasteners.
10. Locate members as indicated on the drawings. Size, spacing or spans shall not be changed without specific approval of Architect. Take care to place proper grades and species of members where indicated in accordance with the lumber schedule herein.
11. Temporary brace framing at the end of each days' work until all framing is completed and securely anchored. Leave temporary bracing in place as long as required for safety. As work progresses, securely connect work to compensate for dead load, wind and erection stresses.

B. Shoring: Construct shoring for masonry where required. Brace and maintain it until the mortar has set sufficiently to permit removal.

C. Blocking: Install 2x6 wood blocking between studs to stiffen the structure and for the support of other work. Provide 2x6 blocking for installation of wall-mounted objects.

D. Nailers: Install nailers of adequate size where detailed. Nailers shall be bolted in place. Where bolt sizes and spacing are not specifically noted, use not less than ⅜" bolts at 32" o.c., staggered.

E. Roof Curbs: Construct wood curbs as detailed to frame openings and support flashings in roof decks.

F. Bucks: Install wood bucks for frames as required. Members shall be at least 2 x 4 material. Spike securely together. In masonry, provide 16 ga. corrugated metal jamb anchors screwed to the back and spaced to work masonry bed joints, not more than 32" apart.

G. Plywood Backing Panels: Screw attach through gypsum board to supports.

3.2 PROTECTION

A. Protect products from moisture absorption and subsequent warping or deterioration until subsequent construction can proceed.

END OF SECTION

SECTION 061053
MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Wood blocking, cants, and nailers.
   2. Wood furring.

1.3 DEFINITIONS

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NELMA - Northeastern Lumber Manufacturers Association.
   2. NLGA - National Lumber Grades Authority.
   3. SPIB - Southern Pine Inspection Bureau.
   4. WCLIB - West Coast Lumber Inspection Bureau.
   5. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":
1. Dimension lumber.
2. Miscellaneous lumber.
3. Interior wood trim.
4. Shelving and clothes rods.
5. Plywood.
6. Oriented strand board.
7. Particleboard underlayment.
8. Hardboard underlayment.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.
5. Provide dry lumber with nineteen percent (19%) maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.
6. Provide dry lumber with fifteen percent (15%) maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood Structural Panels:

1. Plywood
2. Oriented Strand Board
3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
4. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
5. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
      a) Chromated copper arsenate (CCA).
      b) Ammoniacal copper zinc arsenate (ACZA).
      c) Ammoniacal, or amine, copper quat (ACQ).
      d) Copper bis (dimethyldithiocarbamate) (CDDC).
      e) Ammoniacal copper citrate (CC).
      f) Copper azole, Type A (CBA-A).
      g) Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
   2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of nineteen percent (19%) for lumber and fifteen percent (15%) for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 2 Standard, Stud, or No. 3 grade and any of the following species:

1. Mixed southern pine; SPIB.
2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; NELMA.
5. Northern species; NLGA.
6. Western woods; WCLIB or WWPA.

C. Other Framing: Construction, Stud, or No. 2 grade and any of the following species:
1. Douglas fir-larch; WCLIB or WWPA.
2. Douglas fir-south; WWPA.
3. Douglas fir-larch (north); NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Hem-fir (north); NLGA.
6. Southern pine; SPIB.
7. Mixed southern pine; SPIB.
8. Spruce-pine-fir (south); NELMA, WCLIB, or WWPA.
9. Spruce-pine-fir; NLGA.

2.4 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
1. Rooftop equipment bases and support curbs.
2. Blocking.
3. Cants.
4. Nailers.
5. Furring.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with fifteen percent (15%) maximum moisture content and any of the following species:
1. Mixed southern pine; SPIB.
2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; NELMA.
5. Northern species; NLGA.
6. Western woods; WCLIB or WWPA.

C. For exposed boards, provide lumber with fifteen percent (15%) maximum moisture content and any of the following species and grades:
1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine Premium or 2 Common (Sterling) grade; NELMA, NLGA, WCLIB, or WWPA.
2. Mixed southern pine, B & B Finish No. 1 grade; SPIB.
3. Hem-fir or Hem-fir (north), Superior or C & Btr Finish grade; NLGA, WCLIB, or WWPA.
4. Spruce-pine-fir (south) or Spruce-pine-fir, grade; NELMA, NLGA, WCLIB, or WWPA.
5. Western red cedar, A grade; NLGA or WWPA.

D. For concealed boards, provide lumber with fifteen percent (15%) maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Hem-fir or Hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or Spruce-pine-fir, Construction or 2 Common grade; NELMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods, No. 2 Common grade; NELMA.
5. Northern species, No. 2 Common grade; NLGA.
6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking and similar supports to comply with requirements for attaching other construction.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.

F. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

1. Fire block furred spaces of walls, at each floor level and at ceiling, with wood blocking or noncombustible materials accurately fitted to close furred spaces.

END OF SECTION 06105

SECTION 06 40 00

ARCHITECTURAL

WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Standing and running trim, millwork, and display cases.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry.
2. Section 08 14 23 - Plastic-Laminate-Faced Wood Doors.
3. Section 08 71 00 - Door Hardware: masterkey cabinet locks.
4. Section 09 91 00 - Painting: applied finishes.
5. Section 10 12 00 - Display Cases.
6. Section 12 32 16 - Manufactured Plastic-Laminate-Clad Casework.
7. Section 22 40 00 - Plumbing Fixtures.

1.2 SUBMITTALS

A. General: Submit following items in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Manufacturer's technical literature for factory fabricated items and components.

C. Shop Drawings
1. Indicate profiles, sections, and views of stock items as well as specially fabricated items for the work, at scale large enough to permit checking for design conformity.
2. Indicate sizes, quantities, markings, materials, wood species, finishes and accessories.
3. Include assembly and installation drawings to show methods of blocking, fastening, bracing, jointing, and connecting to work of other trades.

D. Samples
1. Two samples of each type and species of plywood, particle board, and finish lumber specified, complete with applied finish.
2. Each type of hardware and fastening device required in the construction of the work specified herein.

E. Certificate: Submit certification by testing plant stating chemicals and process used, conformance with referenced standards and governing ordinances, and non-bleeding quality of treatment.

F. LEED Submittals:
1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
4. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

1.3 QUALITY ASSURANCE

A. Manufacturing Standards: Woodwork shall be manufactured in accordance with the standards in

the current edition of the Architectural Woodwork Quality Standards of the Woodwork Institute. Provide the grade or grades specified and shown on the Drawings. Provide items not identified as a specific quality grade as Premium grade as defined in the Architectural Woodwork Standards - 2014.

B. Mock-up: Construct the mock-up cabinet as designated on the drawings using materials and hardware proposed for the project. The cabinet shall duplicate the typical construction and quality grade specified. Deliver the mock-up cabinet to the project site for approval by Architect. Notify the Architect in writing one week in advance of the mock-up's on-site arrival. Mock-up cabinet shall be made fully acceptable to the Architect through re-manufacture at the millwork shop or through acceptable field corrections prior to commencing construction of other cabinets. Mock-up cabinet shall be properly identified, and, if acceptable to Architect may be installed in the project. Once installed, do not alter or move the mock-up cabinet.

C. Lumber and Plywood Material Grading: As defined in Section 4 - Sheet Products, AWI Architectural Woodwork Standards, and as defined by the rules of the recognized associations of lumber and plywood manufacturers producing the materials specified.

D. Fabrication Standards: Fabricate items in accordance with AWI standards listed below using Premium Grade except at millwork scheduled to be installed in Custodian's Closets and storage rooms, which shall be Economy Grade.
   1. Lumber grades: AWI Section 3 - Lumber.
   2. Miscellaneous Work: AWI Section 6 - Interior & Exterior Millwork.
   3. Painted Millwork: AWI Section 10 - Casework.
   4. Countertops: AWI Section 11 - Countertops.

E. Regulatory Requirements: Conform to applicable code for fire retardant requirements.

F. Accessibility Standards: Meet ANSI Accessibility Standards (ANSI A117.1 - 2017) special requirements for the following:
   1. Countertop height with or without cabinet below
   2. Kneespace clearance to be minimum clearance
   3. 12 inch deep shelving, adjustable and fixed
   4. Wardrobe cabinets, furnished with rod/shelf adjustable to 48 inches above finished floor, with a maximum 21 inch shelf depth.
   5. Sink cabinet clearances
   6. Cabinet locks, latches, and other operating mechanisms, except locked bottom drawers at base cabinets.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver woodwork to the project site only when dry and product storage space is available at or in the building so that it can be kept dry and protected from injury.

1.5 PROJECT CONDITIONS

A. Protection: Protect finish woodwork surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering. Woodwork damaged through neglect of the above requirements shall be repaired or replaced without additional cost to the Owner.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Install finish carpentry products only when temperature and humidity conditions have been stabilized and will be maintained.

B. Maintain temperature and moisture conditions as recommended by woodwork fabricator from date of installation through remainder of construction period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
1. Comply with quality and grading standards contained herein for each material.
2. Sizes noted on drawings or indicated herein for lumber are nominal unless detailed by specific dimensions of actual size.
3. Plywood and particleboard ¾" thickness unless noted or detailed otherwise.
4. Products surfaced four sides, unless noted otherwise.

B. Softwood Lumber
1. Quality standard: PS 20.
2. Grading Standard: AWI Premium grade.
3. Maximum moisture content: 6% for interior work; 10% for exterior work.
4. Species: Douglas fir.
5. Grain: Plain sliced.

C. Softwood Plywood
1. Quality standard: PS 1.
2. Grading standard: AWI Premium grade.
3. Core material: C-D Plugged INT-APA.
4. Face quality: A-B INT-APA.
5. Species: Douglas fir.
6. Ply construction: 3 ply - 3/8-inch; 5 ply - 1/2-inch; 7 ply - 3/4-inch.

D. Hardboard
1. Quality standard: PS 58.
2. Grade: Tempered.
3. Face: Both faces sanded.
4. Thickness: 1/4-inch.

2.2 ACCESSORIES AND TREATMENT

A. Contact Adhesive: FS MMM-A-130B, of type recommended by millwork manufacturer to suit application.

B. Wall Adhesive: Solvent release cartridge type, compatible with substrate, capable of achieving durable bond.

C. Glass: clear tempered, 1/4-inch thick.

D. Bolts, Nuts, Washers, Lags, Pins, Nails, and Screws: Size and type to suit application.

E. Nails: Size and type to suit application, plain finish.

F. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

G. Adhesives shall have a VOC content of 70 g/L or less.

2.3 CABINETS AND COUNTERTOPS

A. General: If practical, cabinets not dependent upon job conditions shall be shop assembled.

B. Identification of Cabinet Parts by Surface Visibility:
1. Exposed Surfaces: Surfaces visible when:
   a. Drawers and opaque doors (if any) are closed.
   b. Behind clear glass doors.

c. Bottoms of cabinets 42 inches or more above finish floor.
d. Tops of cabinets below 78 inches above finish floor.
e. Tops of cabinets or millwork are visible from an adjacent higher elevation.

2. Semi-exposed Surfaces: Surfaces which become visible when.
   a. Opaque doors are open or drawers are extended.
   b. Bottoms of cabinets are more than 30 inches and less than 42 inches above finish floor.
3. Concealed Surfaces: Surfaces considered concealed when:
   a. Surfaces not visible after installation.
   b. Bottoms of cabinets less than 30 inches above finish floor.
   c. Tops of cabinets over 78 inches above finish floor and not visible from an upper level.
   d. Stretchers, blocking, and components concealed by drawers.

C. Millwork for Opaque Finish:
1. AWI Custom Grade.
2. Construction of Millwork: Flush overlay design.
3. Exposed Solid Lumber Parts and Semi-exposed Parts: As governed by selected AWI quality grade unless shown otherwise.

D. Laminate Clad Cabinets:
1. Quality Standard: AWI Section 10 - Casework, Laminate Clad Cabinets, Premium Grade.
2. AWI Type of Cabinet Construction: Flush overlay design.
3. Laminate Grade for Exposed Surfaces:
   a. Horizontal Surfaces other than Tops: GP-50 (0.050-inch nominal thickness).
   b. Vertical Surfaces: GP-28 (0.028 inch nominal thickness).
   c. Edges: GP-50 (0.050-inch nominal thickness).
4. Semi-Exposed Surfaces: Provide high pressure laminate, GP-28, including backs of doors and drawers. Other interior surfaces of drawers may be sealed wood; reference SECTION 09 91 00 - PAINTING.
5. Shop joints will be allowed only when the required lengths exceed the lengths of plastic regularly available. Field joints shall be shop prepared and pre-fitted with bolt-up type fasteners.
6. PVC edging banding will not be acceptable.
7. The use of LPDL (Melamine) will not be acceptable.
8. Plastic Laminate: General purpose grade, high pressure decorative laminate meeting the physical requirements of NEMA LD 3 and with a suede finish. Colors shall be as selected by Architect from manufacturer's full color and pattern range. Architect reserves the right to select one color for the exposed surfaces of the basic components of cabinets and a different color for the following components of cabinets: door and drawer fronts (including edges of door and drawer fronts), backs of open shelving, and countertop and backsplash, unless shown otherwise. Product/manufacturer; one of the following:
   Formica Brand Laminate; Formica Corp.
   Nevamar; Nevamar Co., LLC; Decorative Products Div.
   Wilsonart; Wilsonart International; Div. of Premark International, Inc. Pionite; Panolam Industries
9. Finish Schedule (Bases of Design)

Plastic Laminate 1:

Manufacturer: Wilsonart, Standard Laminate

Color: Burnished Chesnut

SKU #: 4796-60

Finish: Matte Finish

Rooms: Reception 236, Office 200, Office 201, Office 210, Office 211, Conference Room 212, Office 213, Office 218, Office 219, Office 220, Office 221, Office 223, Office 226, Office 227, Office 230, Office 231

Plastic Laminate 2:

Manufacturer: Wilsonart, Premium Laminate

Color: 5th Ave Elm

SKU #: 7966K-12

Finish: Softgrain Finish

AEON Scratch Resistance

Rooms: Classroom 101, Classroom 104, Classroom 110, General Classroom 204, General Classroom 205.

E. Countertops:
1. Quality Standard: AWI Section 11 - Countertops.
2. Type of Top: High pressure decorative laminate complying with Premium Grade.
3. Laminate Cladding for Horizontal Surfaces: High pressure decorative laminate, HGS (0.050-inch nominal thickness) Grade. Laminate shall be selected from one of the manufacturers listed above.
4. Edge Treatment: Same as laminate cladding on horizontal surfaces. Plastic laminate edges shall return across open ends of cabinets.
5. Countertops containing sinks and countertops over dishwashers shall be exterior-grade veneer core plywood, no substitutions.
6. Joints between tops and backsplash shall be square.
7. Joint between backsplash and countertops containing sinks shall be sealed with sanitary, silicone sealant to ensure a tight seal.
8. No joints shall be closer than 24 inches either side of sink cutout.
9. No joints shall occur within kneespace.
10. Seal substrate at sink cutouts with sanitary, silicone sealant.
11. PVC edging will not be acceptable.
12. The use of LPDL (Melamine) will not be acceptable.
13. Finish Schedule (Bases of Design)

Plastic Laminate 1:

Manufacturer: Wilsonart, Standard Laminate

Color: Natural Cotton

SKU #: 4946-38

Finish: Fine Velvet Finish

Rooms: Reception 236, Office 200, Office 201, Office 210, Office 211, Office 213, Office 218, Office 219, Office 220, Office 221, Office 223, Office 226, Office 227, Office 230, Office 231.

Plastic Laminate 2:

Manufacturer: Wilsonart, Standard Laminate

Color: Raw Cotton

SKU #: 4947-38

Finish: Fine Velvet Finish

Rooms: Classroom 101, Classroom 104, Classroom 110, General Classroom 204, General Classroom 205.

F. Solid Surfacing Countertops: Basis of Design shall be Corian Surfaces as manufactured by DuPont**.**
1. AWI Premium Grade.
2. Substrate: Marine grade plywood.
3. Fabricate to detail using 1/2-inch thick solid surfacing.
4. Use seam adhesive and color-matched sealant by manufacturer
5. Color shall be as selected by Architect from full range of manufacturer colors.
6. Edge Treatment: PVC edging will not be acceptable. Reference installation for edge treatment required.
7. Finish Schedule (Bases of Design)

Solid Surface

Manufacturer: Corian Solid Corian

Color: Sand Storm

Rooms: Conference Room 212, Open Office Work Area I201.

2.4 SHELVING

A. Exposed shelving shall be of the same AWI quality grade and finish as the cabinets in which installed.
1. Set fixed shelves on cleats where so detailed, and house other fixed shelves into supports.
2. Adjustable Shelf Supports: Provide twin pin design with anti tip-up shelf restraints for both 3/4-inch and 1 inch shelves. Design to include keel to retard shelf slide-off, and slot for ability

to mechanically attach shelf to clip. Load rating to be minimum 300 lbs each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection. Product/manufacturer; one of the following, no substitutions:
a. SC240 Plastic Shelf Clip; Case Systems, Inc.
b. Cat. No. 282.47.402; Häfele
c. Clear Polycarbonate Shelf Clip; TMI System Design Corp.

2.5 WINDOWSILLS

A. Solid Surfaced Windowsills: Fabricate the windowsill to detail using Corian Surfaces solid surfacing panels as manufactured by Dupont. Use seam adhesive and color-matched sealant by Dupont. Finish shall be matte and color will be selected by Architect from Corian Surfaces.

2.6 TRANSPARENT FINISH

A. AWI Premium quality. Refer TO SECTION 09 91 00 - PAINTING with stain and sheen to be Custom Color as selected by Architect.

2.7 SHOP FABRICATION

A. Fabricate millwork to AWI Premium standards for flush overlay construction as detailed (or as indicated in AWI Section 6 Millwork if details are not present).

B. Sanding/Filling
1. Perform work according to AWI requirements.
2. Sand work smooth and set exposed nails and screws.
3. Apply wood filler in exposed nail and screw indentations and leave ready to receive applied finishes.
4. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.

C. Prime seal concealed and semi-concealed surfaces. Brush apply only.

D. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures. Verify locations of cutouts from site dimensions. Seal edge surfaces of cutouts.

E. Before proceeding with millwork required to be fitted to other construction, field-verify applicable measurements and include on shop drawing details.

F. Fabricate millwork to dimensions, profiles, and details shown.

G. Route and groove back of flat trim members, kerf backs of other wide flat members except plywood or veneered members.

H. Assemble millwork in mill in as large of units as practicable to minimize field cutting and fitting.

I. Miter trim joints, where required, by joining, splining, and gluing to complying with requirements for specified grade.

J. Band exposed plywood and particleboard edges with hardwood trim, 3/8-inch x width of sheet unless otherwise noted or shown to be trimmed with plastic or aluminum.

K. High Pressure Laminate Work:
1. Apply laminate finish in full, uninterrupted sheets of maximum practical lengths. Apply backing sheets to reverse side of items receiving laminate surfacing. Use decorative vertical grade laminate for cabinet interiors.
2. Form corners and butt joints with hairline joints.
3. Do not locate joints within 2 feet' of sink cut-out.

4. Cap exposed edges with laminate.

L. Construction
1. General
   a. Unless otherwise indicated, construct millwork bodies, bottoms, dividers, sides, tops, shelves, doors, drawer fronts and countertops of 3/4-inch sheet material.
   b. Use 1/2-inch thick solid lumber material for drawer sides, back and sub-front.
   c. Use 1/4-inch veneer core panel product for drawer bottoms and cabinet backs, unless noted otherwise.
2. Flush Overlay Reveals
   a. Unless shown or noted otherwise, allow 1/8-inch between adjacent drawers and doors and 1/16- inch at vertical edges.
   b. Allow 1/8-inch reveal at top and bottom of wall cabinets and at bottom of base cabinets.
3. Methods of Joinery
   a. Provide face plates, paneled ends, and construction, glued under pressure.
   b. Provide body web frames of stile plowed and stub tenoned construction.
   c. Join case body members by dado or concealed dowel joints.
   d. Do not use mechanical fasteners or metal clips for attachment of body members to other body members or to web frames.
4. Base cabinets
   a. Use finished end panels unless condition will be fully concealed.
   b. Provide unfinished toe space, prepared to receive base by others.
   c. Construct drawers with Lock Shoulder rabbited (tongue-and-groove) construction.
5. Wall cabinets
   a. Use finished end panels unless condition will be fully concealed.
   b. Provide continuous 1x3 inch anchor cleat at top and bottom of cabinet interior full width of unit. Secure cleat in rabbit over back, then glue and spot pin.
6. Countertops
   a. Provide with 2 inch deep face edge, faced with high pressure laminate unless noted or shown otherwise.
   b. Provide loose 4 inch high pressure laminate covered splashes typically at countertops unless taller splashes shown or noted.
   c. Regardless of drawing indications, provide a 1/2-inch thick wood strip on back side of splash to increase the splash top thickness for coping the splash to the wall.
   d. Countertops containing sinks shall be medium density overlay plywood.

2.8 FINISH

A. Sand work smooth and set exposed nails.

B. Apply wood filler in exposed nail indentations.

C. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.

D. Refer to SECTION 09 91 00 - PAINTING for field applied finish descriptions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify location of wood blocking prior to installation of finish carpentry.

3.2 INSTALLATION

A. Installation of Standing and Running Trim and Millwork: Comply with applicable AWI Section installation requirements.

B. Workmanship: Exposed woodwork shall have a smooth finish, free from machine and tool marks, abrasions, and raised grain on exposed surfaces. Joints shall be tight and formed so as

to conceal shrinkage.

C. Interior Woodwork Installation:
1. Accurately scribe and closely fit face plates, filler strips and trim strips to abutting walls and to irregularities of adjacent surfaces.
2. Set wood finish straight, plumb, and level, in true alignment, and rigidly fastened in place. Nailing and fastening shall be concealed where possible. Set exposed nail heads for puttying.
3. Anchor base and wall cabinets to walls with fully threaded oval head wood screws with finishing washers set at a minimum of 12 inches on center.

D. Solid Surfacing Installation**:**
1. Substrate shall be plywood.
2. Provide 1/8-inch radius at outside corners and edges, unless otherwise recommended by manufacturer.
3. Provide 1/4-inch radius at inside corners, where required to prevent cracking.
4. Provide manufacturer's "best result" recommendations for sanding.
5. Provide a semi-gloss finish. Notify Architect before finishing, if manufacturer's finish recommendations for material color selected differ from semi-gloss.

3.3 CABINET HARDWARE SCHEDULE

A. In addition to the items of hardware specifically noted and shown on the drawing details, furnish and install the following hardware for cabinets. This schedule is intended to include hardware needed to completely equip cabinets specified in this Section. Verify cabinets shown and detailed on the drawings with cabinets listed in this schedule. In the event of omissions in the schedule, furnish hardware of the kind and quality scheduled for similar cabinets.
1. Each 3/4-inch overlay cabinet door more than 3 feet high: 1-1/2 pair Interleaf design hinges HT1592-4 (Stanley).
   1 wire pull 4484 satin aluminum (Stanley). 1 pair Magnetic Catches: 325 (Ives).
2. Each 3/4-inch overlay cabinet door less than 3 feet high: 1 pair Interleaf design hinges HT1592-4 (Stanley).
   1 wire pull 4484 satin aluminum (Stanley). 1 pair Magnetic Catches: 325 (Ives).
3. Each 1-1/2 inch overlay cabinet door more than 3 feet high: 2-1/2 inch Interleaf design hinges HT1592-4 (Stanley).
   1 wire pull 4484 satin aluminum (Stanley).
   1 flap stay No. 499.050.02.0215 or 499.050.03.0215 (Mepla)
   1 pair Magnetic Catches: 327 (Ives).
4. Each cabinet drawer:
   KV #1300 Extension Drawer Slides.
   KV #8400 Extension Drawer Slides at File Drawers. 1 wire pull 4484 satin aluminum (Stanley)
5. Cabinets indicated to be locked:
   a. Each cabinet door: C8055-14A x C2004 US26D (CompX National)
   b. Each drawer: C8055-14A x C2004 US26D (CompX National)
   c. Each pair of cabinet doors:
      1 cabinet lock C8053-14A x C2004 US26D (CompX National) 1 elbow catch No. 2 (Ives)
   d. Cabinet locks in each room shall be keyed alike.
6. Shelf and Rod Hardware:
   1 hanger rod KV660SS
   1 shelf and rod support KV1195

2 rod flanges KV734

7. Grommets: Model No. LO-3 (Doug Mockett & Co., Inc.)
8. Pencil Drawer: Mepla Pencil Drawer, ref. No. 499.405.05.10, color as selected by Architect.
9. Steel Support Brackets (for countertops): Provide one of the following:
   a. Work Station Brackets formed of 1/8-inch steel with powder coat finish as manufactured by A & M Hardware, Inc. (phone 888.647.0200 web site: www.aandmhardware.com). Color as selected by Architect from manufacturer's full color line.
   b. Rakks Counter Support Brackets fabricated of minimum 0.25-inch gauge 6063-T6 extruded aluminum as manufactured by Rangine Corp. (phone 800.826.6006 web site: www.rakks.com). Brackets shall be TIG welded along both 45° mitered sides and across the back. Sharp edges shall be ground and deburred. Color and finish shall be as selected by Architect.

END OF SECTION

SECTION 067113

COMPOSITE LUMBER

Part 1 General

1.1 Section Includes

A. Composite Decking - Trex Enhance Basics and Naturals

1.2 Related Sections

A. Section 06-1100 – Wood Framing

1.3 References

A. ASTM D-7032: Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails), ASTM International.
B. ASTM D-7031: Standard Guide for Evaluating Mechanical and Physical Properties of Wood-Plastic Composite Products, ASTM International
C. ASTM E-84: Test Method for Surface Burning Characteristics of Building Materials, ASTM International.
D. ASTM D 570: Water Absorption of Plastics
E. ASTM D 1761: Mechanical Fasteners in Wood
F. ASTM D1413: Test method for Wood Preservatives by Laboratory Soil-block Cultures
G. ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

1.4 Design/Performance Requirements

A. Structural Performance:
   a. Deck: Uniform Load – An allowable span of 16 in. on-center and 100 lbf/sq.ft.
   b. Tread of Stairs: Concentrated Load: An allowable span of 9 in. on-center, and 750 lbf-, and 1/8” max. deflection, with a concentrated load of 300 lbf on area of 4 sq. in.
B. Fire-Test Response Characteristics per ASTM E-84.
   a. Flame Spread Index– Class C.

1.5 Submittals

A. Product Data Indicate sizes, profiles, surface style, and performance characteristics.
B. Samples: For each product specified, one sample representing actual product color, size, and finish.

1.6 Delivery, Storage, and Handling

A. Store Trex products on a flat and level surface. Support bundles on supplied dunnage.
B. Keep material covered using the provided bundle cover until time of installation.
C. See www. Trex.com for detailed storage recommendations:
   Care and Cleaning Guide for Trex Transcend, Select, and Enhance Decking

1.7 Warranty

A. Specific terms for warranties can be found at; www.Trex.com

Part 2 Products

2.1 Manufacturers

A. Contract Documents are based on products supplied by; Trex Company, Inc., 160 Exeter Dr., Winchester, VA 22603.
B. Substitutions: If Approved Equal, submitted under Division 01 requirements.

2.2 Applications/Scope

A. Wood-Plastic Composite Lumber;
   a. Material Description: Composite Decking consisting of recycled Linear Low Density Polyethylene (LLDPE) and recycled wood. The product is extruded into shapes and sizes as follows:
      i. Trex Enhance Boards; 2 x 5.5".
      ii. Lengths – 12, 16, and 20 feet
      iii. Color – To be specified by owner from Trex' standard list of colors.
   b. Physical and Mechanical Properties as follows:

Test	Test Method	Value
Flame Spread Index	ASTM E 84	Class C
Thermal Expansion	ASTM D1037	1.9×10^{-5} inch/inch/degreeF
Moisture Absorption	ASTM D1037	< 1%
Screw Head Pull-Through	ASTM D1761	161 lbf per screw**
Fungus Resistance	ASTM D1413	Rating - no decay
Termite Resistance	AWPA E1-72	Rating = 9.6

** Fastener used in testing: #8 x 2.5 in. approved Stainless Steel Screw

2.2 Accessories

A. Fasteners:
   a. Trex Universal Hideaway Hidden Fasteners
   b. Other recommended fasteners: Trex Recommended Fasteners.

Part 3 Execution

3.1 Installation

A. Install according to Trex installation guidelines: 2023 Trex Decking Installation Guide.
B. Cut, drill, and rout using carbide tipped blades.
C. Do not use composite wood material for structural applications.

3.2 Cleaning

A. Following cleaning recommendations as found in Trex installation guide at:
   Care and Cleaning Guide for Trex Transcend, Select, and Enhance Decking

END OF SECTION

SECTION 07 05 23

AIR BARRIER PERFORMANCE TESTING

PART 1 – GENERAL

1.1 SUMMARY

A. Employ an independent agency to conduct the pressure test on the building envelope in accordance with this specification section, Section 01 91 19 Building Envelope Commissioning and ASTM E779.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced within the text by the basic designation only.

A. ASTM INTERNATIONAL (ASTM)
   1. ASTM E1186 (2003; R 2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
   2. ASTM E779 (2010) Standard Test Method for Determining Air Leakage Rate by Fan Pressurization

1.3 DEFINITIONS

A. Air Barrier Envelope: Surface that separates the inside air from the outside air. The combination of air barrier assemblies and air barrier components, connect by air barrier accessories are designed to provide a continuous barrier to the movement of air through an environmental separator. A single building may have more than one air barrier envelope. The air barrier surface includes the top, bottom and sides of the envelope. Alternate terms may include “air barrier system” or “air barrier”.
B. Air Leakage Rate: How leaky, or how air tight, a building envelope is. Air leakage rate is normally described in terms of air flow rate for the surface area of the envelope at a defined differential pressure.
C. Blower Door: Commonly used term for an apparatus used to pressurize and depressurize the space within the building envelope and quantify air leakage through the envelope. The blower door typically includes a door fan and an air resistant fabric or a series of hard panels that extends to cover and seal the door opening between the fan shroud and door frame. The door fan is a calibrated fan capable of measuring air flow and is usually placed in the opening of an exterior door. With the air barrier otherwise sealed, air produced by the door fan pressurizes or de- pressurizes the envelope, depending on the fan's orientation.
D. Pressure Test: A generic term for a test in which the envelope is either pressurized or de- pressurized with respect to the outdoors.
E. Negative Pressure Test (Depressurization Test): A test wherein air inside the envelope is drawn to the outdoors. This places the envelope at a lower (negative) pressure with respect to the outdoors.
F. Positive Pressure Test (Pressurization Test): A test wherein outdoor air is pushed into the envelope. This air movement places the envelope at a higher (positive) pressure with respect to the outdoors.

1.4 QUALIFICATIONS

A. Pressure Test Agency: Test shall be performed by the qualified testing agency or the Building Envelope Commissioning Agency.
   1. The test agency is to be an independent third party subcontractor, not an

affiliated or subsidiary of the prime contractor, subcontractors or A/E firm. The agency is to be regularly engaged in pressure testing of commercial/industrial building envelopes. If using blower door, the lead test technician must have at least two years of experience in using such equipment in building envelope pressurization tests.

B. Thermographer Qualifications: Lead thermographer must have an active Level II Certification, with a minimum of two years of building science thermography experience on commercial or industrial buildings.

1.5 CLIMATE CONDITIONS SUITABLE FOR A PRESSURE TEST

A. As the test date approaches, monitor the weather forecast for the test site. Avoid testing on days forecast to experience high winds, rain, or snow. Preferred ambient weather test conditions as stated in ASTM E779 are 0 to 6 km per hour 0 to 4 mph winds and an ambient temperature range of 5 to 35 degrees 95 degrees F. Based on current and forecast weather conditions, the Contractor's representative is to grant final approval for testing to occur.

B. Rain: Do not during rain or if rain is anticipated during test. Rain may temporarily seal cracks and holes, making the envelope appear tighter than it would be in drier conditions.

1.6 WORK PLAN

A. The testing agency shall submit the following not later than (60) calendar days before start of pressure testing work, steps to be taken by the Pressure Testing Agency to accomplish the required testing.
   1. Submit detailed pressure test procedures prior to the test. Provide a plan view showing proposed locations to install blower doors.
   2. Test equipment to be used.
   3. Scaffolding, scissor lifts, power, electrical extension cords, duct tape, plastic sheeting and other Contractor's support equipment required to perform all tests.
   4. Other Contractor's support personnel who will be on site for testing.

1.7 ENVELOPE SURFACE AREA CALCULATION

A. The Architect shall provide the building envelope surface area calculations. The architectural air barrier boundary includes the floor, walls, and ceiling. After construction of the air barrier envelope is complete, field measure the envelope to ensure the physical measurements match the design drawings and the air barrier envelope surface area calculations.

1.8 SUBMITTALS

A. Work Plan: Submitted by the Test Agency.
B. Design Data: Envelope Surface Area Calculations submitted by the Architect.
C. Certificates
   1. Pressure Test Agency
   2. Thermographer Qualifications
   3. Date of Last Calibration of test instruments
D. Test Reports
   1. Pressure Test Procedures
   2. Air Leakage Test Reports
   3. Diagnostic Test

Report PART 2 PRODUCTS

2.1 AIR BARRIER PERFORMANCE REQUIREMENTS

A. Envelope air tightness target: 0.40 CFM/ft2 at 75 Pascals (0.3 inches water gauge) to comply with IECC 2015 as tested per ASTM E779.

2.2 PRESSURE TEST EQUIPMENT

A. Depending on site conditions and size of the building envelope, the test may be conducted using blower door equipment or the building's own supply air system. The testing agency is to supply sufficient quantity of blower equipment that will produce a minimum of 75 Pa differential pressure between the envelope and outdoors using the test methods described herein.

B. Digital Gauges as Test Instruments: Use only digital gauges as measuring instruments in the pressure test; analog gages are not acceptable. The gauges must be accurate to within 1.0 percent of the pressure reading or 0.15 Pa, whichever is greater. Each gage is to have been calibrated within two years of the test. The calibration is to be checked against a National Institute of Standards and Technology (NIST, formerly National Bureau of Standards) traceable standard.

PART 3 EXECUTION

3.1 TESTING REQUIREMENTS

A. The pressure test cannot be conducted until all components of the air barrier system have been installed. After all sealing of the air barrier has been completed inspect the envelope to ensure it has been adequately prepared.
B. During the pressure test, stop all ongoing construction within and neighboring the envelope which may impact the test or the air barrier integrity. The pressure test may be conducted before finishes that are not part of the air barrier envelope have been installed. Recommend testing prior to installing the finished ceilings within the envelope and immediately surrounding it. The absence of finished ceilings allows for inspection and diagnostic testing of the roof/wall interface and for implementation of repairs to the air barrier, if necessary to comply with the maximum allowed leakage.

3.2 PREPARING THE BUILDING ENVELOPE FOR THE PRESSURE TEST

A. Prepare the building envelope in accordance with the approved testing protocol and with ASTM E779.
B. Sealing the plumbing: Prime all plumbing traps located within the envelope full of water.
C. Close and lock all doors and windows in the envelope perimeter.
D. Maintain an Even Pressure within the Envelope:
Ensure the pressure differences within the envelope are minimized by opening all internal air pathways including propping open all interior doors. Distribute test fans throughout the envelope as necessary to ensure the internal pressures are uniform (within 10 percent of the average differential pressure).
If suspended ceilings are in place, temporarily remove approximately 5% of all ceiling tiles or a minimum of one tile from each isolated suspended ceiling space, whichever comprises the greatest surface area.
E. Maintain Access to Mechanical and Electrical Rooms
F. Minimize potential for blowing dust and debris.
G. De-energize air moving devices
H. For any combustion appliances within the building envelope, close fuel valves and verify associated pilot lights are extinguished.
I. Secure dampers closed either manually or using the building's HVAC system controls
J. Test envelope includes HVAC system. All duct work and mechanical systems shall be installed and sealed from the exterior. Supply and return registers shall remain open for the test.

3.3 BUILDING ENVELOPE AIR TIGHTNESS REQUIREMENT

A. For each building envelope, perform pressurization and de-pressurization testing. The purpose of the pressure (air leakage) test is to determine final compliance with the airtightness requirement by demonstrating the performance of the continuous air barrier. An effective air barrier envelope minimizes infiltration and exfiltration through unintended air paths (leaks).

3.4 CONDUCTING THE PRESSURE TEST

A. Conduct the air leakage test per the approved protocol.
B. Do not pressure test until verifying that the continuous air barrier is in place and installed without failures in accordance with installation instructions. During the pressure test periodically inspect temporarily sealed items to ensure they are still sealed. Seals on temporarily sealed items tend to release more readily at higher pressures.
C. Base read line readings must be taken and recorded.

3.5 FAILED PRESSURE TEST

A. If the pressure test fails to meet the established criteria, use diagnostic test methods described in ASTM E1186 for locating leaks, such as thermographic imaging or other approved method of leak detection.
B. Provide additional permanent sealing measures to reduce or eliminate leak sources discovered during diagnostic testing.
C. Retest (perform another pressure test) after sealing has been completed.
D. Repeat this sequence of documenting test results in the test report, performing diagnostic tests, documenting recommendations for additional sealing measures in the test report, sealing leak locations per recommendations, and re-testing as necessary until the building envelope passes the pressure test and is in compliance with the performance requirements.

3.6 AIR LEAKAGE TEST REPORT

A. Report volumetric flow rates and corresponding differential pressures in cubic feet per minute (cfm) and Pascals (Pa). Analyze data according to the calculations in ASTM E779 taking into account the elevation of the project site.
B. Indicate if the resulting leakage rate did or did not meet the goal leakage requirement. Identify and document deficiencies in the building construction upon failure of a test to meet the specified maximum leakage rate.
C. Document test set-up conditions to ensure the tests can be repeated.
D. If the building envelope fails to meet the leakage rate goal, provide recommendations to further seal the envelope and document these recommendations in the test report.
E. The lead pressure test technician is to prepare, sign, and date the test agenda, equipment list, and submit a certified Air Leakage Test Report.
F. The Contractor is to prepare a final report that identifies improvements that were made to the envelope to reduce leaks, repair insulation voids, or other issues discovered during diagnostic tests. Jointly submit all reports.

3.7 AFTER COMPLETION OF THE PRESSURE AND/OR DIAGNOSTIC TEST

A. After all pressure and/or diagnostic testing has been completed unseal all temporarily sealed items. Unless otherwise directed by the Contractor, return all dampers, doors, and windows to their pre- test condition. Remove tape and plastic from all temporarily sealed openings, being careful not to deface painted surfaces. If paint is removed from finished surfaces, repaint to match existing surfaces.

3.8 REPAIR AND PROTECTION

A. Repair and protection is the General Contractor's responsibility, regardless of the assignment of responsibility for testing, inspection, and similar services. Upon completion of inspection, testing, or sample taking and similar services, repair damaged construction and restore substrates and finishes, protect construction exposed by or for quality control service activities, and protect repaired construction.

END OF SECTION

SECTION 07 05 43

CLADDING SUPPORT SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Provide air and water-resistive barrier, continuous noncombustible mineral wool insulation, sub-construction, and exterior code compliant cladding for vertical above grade exterior walls.

B. Section Includes: Engineered, tested, adjustable, thermally efficient structural system of brackets, rails/profiles, fasteners, and accessories for attachment of exterior Aluminum Composite Metal Panel cladding as part of a cavity or rainscreen wall assembly.

C. Related Sections

1. Section 03 30 00: Cast-in-Place Concrete
2. Section 04 22 00: Concrete Unit Masonry
3. Section 05 40 00 - Cold-Formed Metal Framing
4. Section 06 16 00 - Sheathing
5. Section 07 21 00 - Thermal Insulation
6. Section 07 26 00 - Vapor Retarders
7. Section 07 27 00 - Air Barriers
8. Section 07 21 13 - Mineral Board Insulation
9. Section 07 21 16 - Blanket Insulation
10. Section 07 27 26 - Fluid-Applied Membrane Air Barriers
11. Section 07 42 43 - Composite Wall Panels
12. Section 07 62 00 - Sheet Metal Flashing and Trim
13. Section 07 92 00 - Joint Sealants

1.2 WALL ASSEMBLY DESCRIPTION

A. The wall assembly shall include the following components:

1. Substrate: stud wall with sheathing
2. Air and Water-Resistive Barrier
3. Mineral Wool insulation
4. Thermally Efficient Structural Sub-construction for Exterior Cladding
5. Exterior Cladding

1.3 SUBMITTALS

A. Manufacturer's specifications, details, installation instructions and product data

B. Manufacturer's standard warranty

C. Samples for approval as directed by architect or owner

D. Prepare and submit project-specific shop drawings

E. Engineering calculations by qualified New Mexico licensed PE

F. Prepare and submit project specific shop drawings

1.4 REFERENCES

A. ANSI/ASHRAE Standards

ANSI/ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings

B. IECC

International Energy Conservation Code-2021

C. ASTM Standards

ASTM A1046 Standard Specification for Steel Sheet, Zinc-Aluminum-Magnesium Alloy-Coated by the Hot-Dip Process

ASTM A370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products

D. EN Standards

EN 755 Aluminium and Aluminium Alloys – Extruded rod/bar, tube and profiles

EN 10346 Continuously Hot-Dipped Coated Steel Products for Cold Forming

E. NFPA Standards

NFPA 220 Standard on Types of Building Construction

NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components

1.5 DESIGN REQUIREMENTS

A. Contractor is responsible for designing system, including anchorage to structural support and necessary modifications to meet specified requirements and maintain visual design concepts.

B. Employ registered professional engineer, licensed to practice engineering in jurisdiction where project is located, to engineer layout and fastening of cladding support system to resist wind loads in accordance with applicable building code requirements.

C. Structural Design: Provide thermally efficient Sub-construction system capable of withstanding effects of load and stresses from dead loads, wind loads, ice loads (if applicable) as indicated

on project Structural Notes within the Structural Construction Drawings, and normal thermal movement without evidence of permanent defects of Sub-construction assemblies or components.

1. Wind Load: as indicated on Structural Drawings, acting inward or outward. 45LBS/SQFT Design for allowable deflection in accordance with cladding manufacturer's requirements.

2. Dead Loads: Design for loading to accommodate support of cladding system specified by related sections and shown on Construction Drawings or Shop Drawings as required by local building code.

3. Tolerances: Accommodate deflection of structural members, maintain clearance, and prevent load transfer to non-structural elements.

4. Thermal movements: Design for movement due to cyclic day and night temperatures to not exceed safety factors for fasteners, joints, and components.

D. Conform with fire-resistive design requirements of IBC 2021.

E. Ventilated Rainscreen Design (if applicable): provide design details for ventilation air movement into the rainscreen through the wall cavity and to move water vapor out.

F. Joints

1. Provide joints where they exist in the supporting wall construction - at expansion, control, and cold joints, at changes in support construction (e.g., masonry to frame wall), at junctures with dissimilar construction, at different substrates, at floor lines in multi-story wall construction, at changes in building height and other areas of stress concentration

G. Insulation Thickness

1. Standard Mineral Wool thickness up to 8 inch (203mm).

2. Custom Mineral Wool thickness available where required by code.

H. Sub-Construction

1. StoVentro brackets, long-length profiles, and fasteners available in Aluminum and Zn-Al-Mg-galvanized steel brackets and aluminum profiles as defined herein.

2. Bracket sizes, heights, spacing, and layout determined by design pressures on the project. See StoVentro Load Tables or contact Sto Corp. for engineering of the system.

1.6 PERFORMANCE REQUIREMENTS

NOTE: For detailed performance, test results and criteria, refer to StoVentro test data and analysis, and cladding manufacturer's data and analysis.

A. Air and Water-Resistive Barrier

1. Vapor permeable air and water-resistive barrier in compliance with ASTM E2178 allowable air leakage of 0.004 cfm/ft2 (0.02 L/s/m^2) and ASTM E2357 allowable air leakage of 0.04 cfm/ft2 (0.2 L/s/m^2)

2. Water-resistive barrier in conformance with physical requirements of ASTM E2570

B. Sub-construction attachment system performance: Comply with requirements to resist dead loads and design wind pressures.

C. Thermal Performance:

1. Non-combustible mineral wool insulation as defined by NFPA 220 in compliance with ASTM E136 and ASTM C612 Type IV requirements with 0 flame spread and 0 smoke development when measured in accordance with ASTM E84

2. Wall Assembly effective R-Value: R-7.5 CI + R-19 IN WALL CAVITY – Provide thermal break at each attachment point

3. Full construction wall assembly (sheathing, sub-construction, interior and exterior insulation, air films, etc.) shall be thermally analyzed to ensure compliance with U-value requirement for applicable climate zone(s).

4. Perform effective R-Value calculations or modeling in accordance with ASHRAE / IECC guidelines.

D. Sub-construction Material Properties:

1. 3.2mm and 4.2mm, Large (FP) and Small (GP) wall brackets, quality EN AW-6063 T66 aluminum, tolerance in accordance with EN 755-9, or 6005A-T5 aluminum, tolerance in accordance with ASTM A370-19.

2. 2.0mm, Large (FP) and Small (GP) wall brackets, Grade 80 HSLAS-F + ZM115 galvanized steel in accordance with ASTM A1046 Type 1 specification, or Grade S550GD (1.0531) + ZMM430 galvanized steel conforming to EN 10346.

3. Minimum 2.0mm aluminum alloy T-profiles, L-profiles, or other StoVentro profiles, EN AW-6063 T66 per EN 755-2, or 6005A-T5 with minimum tensile strength of 38 ksi (262 N/mm^2) and 6005A-T5 aluminum tolerance in accordance with ASTM A370-19

E. Fire Break

1. Metal Fire Break - Minimum 0.38mm corrosion resistant metal of sufficient dimension to overlap inner face of carrier board by minimum 10mm (~3/8in)

2. Composite Fire Break – Sto Lamella – Nominal 8.5 lb/ft^3 (136 kg/m3) density, minimum 4 in (~100mm) tall non-combustible mineral wool insulation lamella strip (fibers oriented perpendicular to wall), faced with intumescent tape, nominal 75 lb/ft^3 (1200 kg/m^3) flexible intumescent material of exfoliated graphite that foams up under influence of pressure and temperature

3. Dual Barrier Fire Break – Sto Lamella - Nominal 8.5 lb/ft^3 (136kg/m^3) density, minimum 4 in (~100mm) tall non-combustible mineral wool insulation lamella strip (fibers oriented perpendicular to wall), cut for compression fit between vertical T-Profiles, and combined with metal fire break, minimum 0.38mm corrosion resistant metal of sufficient dimension to overlap inner face of carrier board by minimum 10mm (~3/8in), faced with minimum 50mm (2in) tall intumescent tape

1.7 QUALITY ASSURANCE

A. Manufacturer Requirements

1. Air and water-resistive barrier manufacturer for a minimum of thirty-five (35) years
2. Minimum 5 years' experience specializing in the manufacturing of façade attachment/support framing similar to those specified.
3. Ability to demonstrate conformance to design requirements through testing or analysis.

B. Installer Requirements

1. Engaged in application of similar systems for a minimum of three (3) years
2. Employ skilled mechanics who are experienced and knowledgeable in curtain wall and rainscreen wall application, and familiar with the requirements of the specified work
3. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with specifications and details for the project

C. Engineering Qualifications: Registered professional engineer experienced in the design of curtain wall systems, anchors, fasteners and licensed to practice engineering in the jurisdiction where project is located.

D. Pre-Construction/Mock-up Meeting:

1. Construct full-scale mock-up of typical air/water-resistive barrier and exterior cladding /window wall assembly in accordance with provisions of Division 01, manufacturer's instruction, and requirements of project specifications. Where mock-up is tested at job site maintain approved mock-up at site as reference standard. If tested off-site accurately record construction detailing and sequencing of approved mock-up for replication during construction. Establish sequence and scheduling of work and interface with other trades.

E. Inspections

1. Provide independent third-party inspection where required by code orcontract documents
2. Conduct inspections in accordance with code requirements and contract documents

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product. Store cartons and bundles of material inside in a dry area until ready for use on pallets. Store off the ground on pallets in a dry location out of direct sunlight during installation.

B. Store cartons and bundles of material inside in a dry area until ready for use on pallets. At the job site store off the ground on pallets in a dry location out of direct sunlight.

C. Store wet products (pail products) in a dry area and protect from extreme heat, 90°F (32°C), freezing, and direct sunlight

1.9 PROJECT/SITE CONDITIONS

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product

B. Store sub-construction, fasteners and accessory products in a dry location off the groundout of direct sunlight

C. Provide supplementary heat for installation of sub-construction in temperatures less than 25°F (-3.8°C)

D. Provide a secure staging area for storage of sub-construction components to protect from damage from construction activities

E. Provide protection of surrounding areas and adjacent surfaces from application of products

1.10 COORDINATION/SCHEDULING

(The work in this section requires close coordination with related sections and trades. Sequence work to provide protection of construction materials from weather deterioration)

A. Provide site grading such that the wall cladding assembly terminates above cladding manufacturer's requirements.

B. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuously connected air and moisture barrier

C. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall

D. Schedule work such that the air and water-resistive barrier is exposed to weather no longer than 180 days

E. Install window and door head flashing immediately after windows and doors are installed

F. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior

G. Install sheet metal flashing and trim closures at terminations with windows, doors, and similar through wall penetrations

H. Attach penetrations at pre-determined locations and through prefabricated holes in the wall cladding to structural support and provide watertight seal to air and moisture barrier andthe cladding.

I. Install sub-construction after air and water-resistive barrier is completely dry

J. Install fire breaks at floor lines, openings, and other required locations

K. Install continuous insulation between or over sub-construction

L. Install sill flashings, copings, jamb closures, and sealant immediately after installation of the finished wall assembly

1.11 WARRANTY

Provide manufacturer's standard warranty

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide air and water-resistive barrier, sub-construction, and insulation from single source manufacturer or approved supplier.

B. The following are acceptable manufacturers:

1. Sto Corp. – StoVentro™ sub-construction components

2.2 AIR AND WATER-RESISTIVE BARRIER

Note: Select any of the listed joint treatment/rough opening protection/detail component options and top coat with one of the listed air and water-resistive barrier coatings

A. StoGuard®

1. Joint Treatment, Rough Opening Protection, and Static Transition Detail Components:

a. Sto Gold Fill® – ready mixed coating applied by trowel or knife for rough opening protection of frame walls and joint treatment of sheathing when used with StoGuard Mesh. Also used as a detail component with StoGuard Mesh to splice over back flange of starter track, flashing, and similar ship lap details

b. Sto AirSeal™ with StoGuard Fabric and RediCorners - ready mixed coating applied by brush, roller, or spray for joint treatment of sheathing when used with StoGuard Fabric, and rough opening protection of frame walls when used with StoGuard Fabric and RediCorners. Also used as a detail component with StoGuard Fabric to splice over back flange of starter track, flashing, and similar ship lap details

c. Sto RapidGuard® - one component STPE rapid drying gun-applied treatment for sheathing joints, rough openings, seams, cracks, penetrations, and other static transitions in above grade wall construction

2. Air and Water-Resistive Barrier Coating

a. Sto AirSeal® – ready mixed vapor permeable air and water-resistive barrier coating for concrete, concrete masonry, brick masonry, wood-based sheathing, cementitious sheathing, and glass mat gypsum sheathing

b. Alternatives:

A. Sto Gold Coat® – ready mixed vapor permeable air and water- resistive barrier coating for concrete, concrete masonry, brick masonry, wood-based sheathing, cementitious sheathing, and glass mat gypsum sheathing

B. Sto VaporSeal® – fluid-applied Class 1 vapor retarder and air and water-resistive barrier for concrete, concrete masonry, brick masonry, wood-based sheathing, cementitious sheathing, and glass mat gypsum sheathing

3. Static or Dynamic Transition Detail Component

a. StoGuard Transition Membrane – flexible air barrier material for continuity at static

transitions such as sheathing to foundation, dissimilar materials (CMU to frame wall), wall to balcony floor slab or ceiling, and shingle lap transitions to flashing. Also used for dynamic joints: floor line deflection joints, masonry control joints, and through wall joints in masonry or frame construction

2.3 INSULATION BOARD

1. Rockwool Cavityrock® mineral wool insulation board in conformance with ASTM C612, Type IV requirements, nominal 4.3 lb/ft^3 density (0.28 kg/m^3), and R-4.3 per inch (RSI - 0.74 per 25mm)
   a. Minimum 2 inch for construction Types I-IV
   b. Optional – Black version for camouflaging the mineral wool at open panel joints

2.4 FLOOR LINE FIRE STOP

Note: A, B, and C are acceptable alternatives.

A. Metal fire break

1. Minimum 0.38mm corrosion resistant metal of sufficient dimension to overlap inner face of carrier board by minimum 10mm (~3/8in)

B. Composite Fire Break - mineral wool insulation with surface mount intumescent tape:

1. Sto Lamella mineral wool insulation board in conformance with ASTM C612, Type IV requirements, nominal 8.5 lb/ft^3 density (136.2 kg/m^3), and R-3.2 per inch (RSI - 0.56 per 25mm) with glass fibers oriented perpendicular to the plane of the wall.

2. Rolf Kuhn 2mm (~1/16in) ROKU® intumescent strip with adhesive backing (field applied over insulation – refer to Sto Details)

C. Dual Barrier Fire Break – mineral wool insulation with metal fire break and intumescent tape

1. Sto Lamella mineral wool insulation board in conformance with ASTM C612, Type IV requirements, nominal 8.5 lb/ft^3 density (136.2 kg/m^3), and R-3.2 per inch (RSI - 0.56 per 25mm) with glass fibers oriented perpendicular to the plane of the wall.

2. Minimum 0.38mm corrosion resistant metal of sufficient dimension to overlap inner face of carrier board by minimum 10mm (~3/8in) (field applied over insulation – refer to Sto Details)

3. Rolf Kuhn 2mm (~1/16in) ROKU® intumescent strip with adhesive backing (field applied over metal fire break – refer to Sto Details)

2.5 SUB-CONSTRUCTION

A. StoVentro aluminum or galvanized steel (Zn-Al-Mg) brackets and aluminum T-profiles, L-profiles, and other cross-sectional profiles capable of complying with ANSI/ASHRAE 90.1 and IECC-2021.

B. Steel Classification: Galvanized Steel (Zn-Al-Mg)

1. StoVentro Bracket – Zn-Al-Mg, material properties grade – HSLAS-F Gr 80 + ZM 115 or S550GD + ZMM430

C. Aluminum Classification: Aluminum (ALUM)

1. StoVentro Bracket – ALUM, material properties are 6063-T66 aluminum

2. StoVentro T-Profile, material properties are 6063-T66 or 6005A-T5 aluminum

3. StoVentro L-Profile, material properties are 6063-T66 or 6005A-T5 aluminum
4. StoVentro profiles of other cross-sectional shapes, material properties are 6063-T66, 6063-T6, or 6005A-T5 aluminum

    a. ½" hat channel

    b. 1" hat channel

    c. Agraffe rail

    d. Carrier rail

D. Bracket and Rail Spacing: Comply with Professional Engineer's project specific calculations for wall brackets and profiles or pre-engineered and certified designs.

E. Wall Brackets

1. StoVentro Bracket – ALUM is an aluminum wall bracket. include thermal break accessory with the brackets to minimize thermal bridging effects. Brackets range in depth from 40mm to 320mm, in 20mm increments (~1 9/16" - ~12 5/8" in ~13/16" increments). Brackets provide 30mm (~1 3/16") adjustability. Large Brackets (FP) transfer dead loads and wind loads to the primary structure. Small Brackets (GP) transfer only wind loads to the primary structure.

    a. ALUM FP/GP (choose sizes 40 to 320mm)

2. StoVentro Bracket – Zn-Al-Mg is a galvanized steel wall bracket. Zn-Al-Mg brackets range in depth from 60mm to 360mm, in 20mm increments (~2 3/8" - ~14 3/16" in ~13/16" increments). Zn-Al- Mg brackets are available with spring fingers, for insertion of StoVentro T or L Profiles, beginning at 80mm depth. Brackets provide 30mm (~1 3/16") adjustability. Large Brackets (FP) transfer dead loads and wind loads to the primary structure. Small Brackets (GP) transfer only wind loads to the primary structure.

    a. Zn-Al-Mg FP/GP (choose sizes 60 to 360mm)

    b. Zn-Al-Mg with spring finger FP/GP (choose sizes 80 to 360mm)

    Note: StoVentro brackets of stainless-steel material were included in NFPA 285 Fire Test and corresponding proprietary Sto Corp design listings. StoVentro ALUM and Zn-Al-Mg brackets were not included in NFPA 285 Fire Test. Contact Sto Corp. for status of design listings for each of these bracket materials and verify conformance of final wall assembly with NFPA 285 acceptance criteria.

F. Support Profiles are aluminum rails/profiles. The profiles are the supporting sub-construction of the specified wall cladding. StoVentro L-Profiles are acceptable for use where the cladding panel fastener to edge distance design allows, and are also used to stiffen outside corners at cantilevered sections. For camouflaging the aluminum profiles at open cladding panel joints, add black direct-to-metal paint (prior to cladding installation).

1. StoVentro T-Profiles come in lengths of 3m and 6m (~9'-10" and ~19'-7") and have a bearing surface of 90mm (~3 9/16") or 120mm (~4 3/4") Note: 120mm T-Profiles are a special order item only

2. StoVentro L-Profiles come in lengths of 3m and 6m (~9'-10" and ~19'-7") and have a bearing leg surface of 40mm (~1-9/16") and 50mm (2")

3. StoVentro profiles of other cross-sectional shapes required for use in hidden fastener cladding panel attachment or additional face-fastener cladding attachment applications, come in lengths as follows:

   a. Carrier Rail - 3m (~9'-10").

   b. Agraffe Rail - 3m (~9'-10").

   c. Hat Channel: ½" or 1" depth x 8, 10, or 12 foot lengths possible

G. Thermal isolation

1. The optional components may be used with StoVentro Brackets – ALUM, Zn-Al-Mg

   a. Thermal Blocking Element for ALUM, Zn-Al-Mg StoVentro brackets– 6mm (~1/4") thick thermal break accessory that isolates the wall bracket from thermal bridging effects of the primary structure, in two sizes to match the footprint of the large or small bracket.

   b. Thermal Sliding Element – 1mm (1/32") thick thermal break accessory that isolates the StoVentro 'T'-Profiles, 'L'-Profiles, or other StoVentro profiles from thermal bridging effects of the wall bracket.

   Note: Thermal isolation elements were not included in NFPA 285 Fire Test. Contact Sto Corp. for status of design listing for each of these components.

H. Fasteners – profile and bracket connectors

1. StoVentro Sub-construction screw is a self-drilling, hexagonal head stainless steel screw with a hardened drill point and overtightening protection for attachment of StoVentro T-Profiles and StoVentro L-Profiles, or other StoVentro profiles to StoVentro Brackets.

   a. Size: 5.5mm x 22mm (~3/16" x 7/8"), 500 per box (typical package size)

2.6 FASTENERS

A. Sub-construction attachment to exterior building wall

   a. Attachment to steel studs. StoVentro bracket to steel stud attachment screw is a ¼-14, high drilling capacity, self-drilling, hexagonal head, bi-metal (stainless steel + carbon steel) screw for attachment of StoVentro Brackets to (18g-12ga) steel studs. *Only length of 2" is available from Sto*. The StoVentro bracket to steel stud attachment screw includes an integral stainless steel + EPDM bonded washer of 19/32" diameter. Performance data shall meet:

      A. Material thickness drill capacity

         - .105" (2.7 mm) carbon steel
         - .125" (3.2 mm) aluminum

      B. Material Strength

         - Tensile: 3400 lbf / 15124 N
         - Shear 2400 lbf / 10676 N
         - Torsional 140 lbf in / 15.4 N m

C. Pull Out Strength

- 12ga: 1941 lbf / 8634 N
- 14ga: 1285 lbf / 5716 N
- 16ga: 794 lbf / 3532 N
- 18ga: 681 lbf / 3029 N

b. Attachment to concrete, grout-filled CMU, and wood exterior building walls

A. Contact Sto Corp.

2.7 CLADDING

A. Refer to Division 07 Section 07 42 00

2.8 ACCESSORIES

A. StoSeal STPE Sealant - high-movement, low modulus, non-sag one-component silyl-terminated polyether joint sealant in compliance with ASTM C920 (Type S, Grade NS, Use NT, A, M, Class 100/50) and tested in accordance with ASTM C1382

PART 3 EXECUTION

3.1 ENGINEERING AND SHOP DRAWINGS

A. Cladding sub-contractor shall provide engineering and shop drawings identifying attachments to back-up wall construction structural supports, location and type of fire breaks, layout of sub-construction components (including fixed or sliding point brackets) and connections (fixed or sliding point), cladding locations and joint spacing, sill flashing, copings, jamb closures, and joint sealant type(s) and location.

3.2 ACCEPTABLE INSTALLERS

A. Prequalify under Quality Assurance requirements of this specification (section 1.7 B)

3.3 EXAMINATION

A. Inspect surface plane for compliance with tolerance of not greater than 1/4 inch in 10 feet [6mm in 3.0m] deviation in plane.

B. Report deviations from the requirements of project specifications or other conditions that might adversely affect the insulation board, sub-construction, or cladding installation to the General Contractor. Do not start work until deviations are corrected.

3.4 SURFACE PREPARATION

A. Remove surface contaminants, repair cracks, spalls or damage in concrete and concrete masonry surfaces and level concrete and masonry surfaces to comply with required tolerances. Repair holes, gaps, over-driven fasteners in sheathing surfaces, and replace damaged sheathing

3.5 INSTALLATION

NOTE: The air/water-resistive barrier described below is one set of materials in the air barrier system and the moisture protection for the structure. Installation of the air/moisture barrier must be integrated with flashing and other air and moisture barrier materials to ensure that where water is likely to penetrate the wall assembly, it will be drained to the exterior at the source of the leak. Proper air barrier connections and integration of the air/moisture barrier through proper sequencing of work and coordination of trades is

necessary for a complete air barrier system and complete moisture protection.

IMPORTANT: Ensure the air/moisture barrier surface, insulation board surface, and reinforced base coat surface are free of surface contamination. Install Sto GPS Insulation Board within 180 days of the application of Sto Gold Coat.

3.6 AIR/WATER-RESISTIVE BARRIER INSTALLATION

A. Air/Water-Resistive Barrier Installation over Exterior or Exposure I Wood-Based Sheathing (Plywood and OSB), Glass Mat Faced Gypsum Sheathing in Compliance with ASTM C1177, and Concrete, or Concrete Masonry (CMU) Wall Construction

1. Transition Detailing

a. Detail transition areas with Sto RapidGuard or StoGuard Transition Membrane to achieve air barrier continuity. For illustrations of installation, refer to Sto Guide Details and Sto RapidGuard Installation Guide or StoGuard Transition Membrane Installation Guide (www.stocorp.com).

2. Rough Opening Protection (select 1, 2 or 3 for frame construction; for concrete or concrete masonry rough openings with wood bucks and similar openings with complex 3-dimensional geometry, select no. 3, Sto RapidGuard):

a. Sto Gold Fill with StoGuard Mesh: apply 9 inch (229 mm) wide StoGuard Mesh at rough openings. Immediately apply Sto Gold Fill by spray or trowel over the mesh and spread with a trowel to create a smooth surface that completely covers the mesh (refer to Sto Detail 22s.20M).

b. Sto Gold Coat with StoGuard Fabric: apply coating liberally by spray or roller to corners of openings, immediately place StoGuard RediCorners in the wet coating, and apply additional coating over the RediCorners to completely embed them. After all corners have been completed apply coating liberally to the entire rough opening, immediately place StoGuard Fabric in the wet coating, smooth any wrinkles with a brush or roller, and apply additional coating over the fabric to completely embed it. Overlap all seams minimum 2 inches (51 mm). Once completed top coat with additional coating as needed to completely seal the surface. Allow to dry and inspect for pinholes or voids. If pinholes or voids are present, seal with additional coating or Sto RapidGuard (refer to Sto Detail 22s.20F).

c. Sto RapidGuard: apply a fillet bead of material with a caulking gun at interior corners inside the opening to seal jamb/sill and jamb/head seams. Apply material in a zig-zag pattern along sill, jambs, and head to form a generous bead of material along the surface to be covered. Use a 6 inch (152 mm) wide plastic drywall knife to spread the material to a uniform thickness of 12-20 mils (0.3-0.5 mm) before the material skins. Treat the entire rough opening surface in this manner and overlap onto the face of the sheathing 2 inches (51 mm) minimum all the way around (refer to Sto Detail 22s.20RG)

3. Sheathing Joint Treatment (select one)

a. Sto Gold Fill with StoGuard Mesh: place 4 inch (102 mm) wide mesh centered along sheathing joints and minimum 9 inch (229 mm) wide mesh centered and folded at inside and

outside corners. Immediately apply Sto Gold Fill by spray or trowel and spread with a trowel to create a smooth surface that completely covers the mesh.

b. Sto Gold Coat with StoGuard Fabric: apply coating liberally by spray or roller along sheathing joints and immediately place 4 inch (102 mm) wide fabric centered over the joints into the wet coating, and 6 inch (152 mm) wide fabric centered and folded at inside and outside corners into the wet coating. Smooth any wrinkles with a brush or roller and apply additional coating to completely embed the fabric. Overlap seams minimum 2 inches (51 mm).

c. Sto RapidGuard: apply to properly installed sheathing - joints butted for gypsum sheathing, and joints gapped for plywood and OSB sheathings (wood-based sheathing typically requires 1/8 inch [3 mm] spacing at edge and end joints). Apply a thick bead of Sto RapidGuard with a caulking gun along sheathing joints or apply in a zig-zag pattern across and down the joints. Spread to a uniform thickness of 20-30 mils (0.5-0.6 mm) before the material skins. Spread 1 inch (25 mm) beyond the sheathing joint on each side. Follow the same procedure for inside and outside corners.

4. Air/Water-Resistive Barrier Coating Installation – Sto Gold Coat® - Substrate-Driven spec (medium and high build specifications are also options)

a. Plywood and Gypsum Sheathing: apply the air and moisture barrier coating by spray or roller over sheathing surface, including the dry joint treatment, rough opening protection, and transition areas, to a uniform wet mil thickness of 10-12 mils in one coat (Sto Gold Coat). Use ½ inch (13 mm) nap roller for plywood. Use ¾ inch (19 mm) nap roller for glass mat faced gypsum sheathing. Protect from weather until dry.

b. OSB Sheathing: apply the air and moisture barrier coating by spray or with a ¾ inch (19 mm) nap roller to sheathing surface to a uniform wet mil thickness of 20 mils. Touch up any areas with raised OSB strands or voids to provide a void and pinhole free surface. Protect from weather until dry.

c. CMU Surfaces:

Repair static cracks up to 1/2 inch (13 mm) wide with Sto RapidGuard. Rake the crack with a sharp tool to remove loose or friable material and blow clean with oil-free compressed air. Apply the crack filler with a trowel or putty knife over the crack and tool the surface smooth. (Note: For moving cracks or cracks larger than ½ inch [13mm]), consult with a structural engineer for repair method). Protect repair from weather until dry.

Liberally apply AWRB coating to the surface with a ¾ inch nap roller or spray equipment to a wet thickness of 20-60 mils, depending on surface condition. Apply to a uniform thickness. Apply one or more additional coats to provide a void and pinhole free surface. Protect from weather until dry.

IMPORTANT: The Sto coating functions as an air and water-resistive barrier on normal weight concrete masonry wall construction with flush (struck flush with the surface of the CMU) or concave joints when minimum two liberal coats are applied. Additional coats may be necessary depending on the condition of the CMU wall surface, CMU porosity, joint profile, and other variables that may exist. For "rough" CMU wall surfaces, skim coat the entire surface with one of Sto's cementitious levelers (Sto BTS Plus or Sto BTS Xtra) before application of coating. A VOID AND PINHOLE FREE SURFACE must be achieved for the coating to properly function as an air and moisture barrier on CMU wall surfaces.

5. Air/Water-Resistive Barrier Connections and Shingle Laps

   a. Coordinate installation of connecting air barrier components with other trades to provide a continuous airtight membrane.

   b. Coordinate installation of flashing and other moisture protection components with other trades to achieve complete moisture protection such that water is directed to the exterior, not into the wall assembly, and drained to the exterior at sources of leaks (windows, doors and similar penetrations through the wall assembly).

   c. Splice-in head flashings above windows, doors, floor lines, roof/sidewall step flashing, and similar locations with StoGuard detail component to achieve shingle lap of the air/moisture barrier such that water is directed to the exterior.

NOTE: Windows and doors are typically installed following installation of the air/moisture barrier and work should be sequenced accordingly. Consult with window manufacturer for installation requirements to maintain air barrier continuity and for head, jamb, sill flashing and perimeter sealant requirements needed to prevent leaks into the wall assembly.

3.7 SUB-CONSTRUCTION INSTALLATION

A. Install Sub-construction in strict accordance with manufacturer's installation instructions, prescriptive designs, and/or engineering shop drawings.

B. Install Sub-construction to be level, plumb, and in alignment with building features including corners, off-sets, and penetrations.

C. StoVentro Wall Brackets and StoVentro T-profile, L-Profile or other StoVentro profiles

   1. Mount wall brackets at {16} {24} {32} {48} inches on center horizontally to supporting wall construction as indicated by engineering shop drawings.

      a. Brackets must be laid out at 1/2-inch increments vertically.

      b. Tighten screws to structural wall to a snug tight condition and not stripped. Do not over-torque beyond manufacturer's recommendation. If installed using hand tools, verify for each installer at beginning of project using snug-tight criteria. Do not use stripped holes.

   2. Attach StoVentro profile to wall brackets in accordance with engineering shop drawings, align plumb and level, and account for irregularities in supporting wall construction.

   3. Establish and re-establish and restart bracket locations using laser or chalk-line at penetrations and other obstructions to establish alignment.

D. Thermally isolate wall brackets, as needed, by inserting thermal isolation materials between wall brackets and substrate.

E. Attach T-Profiles and L-Profiles, or other StoVentro profiles by use of StoVentro Sub-construction screw through pre-punched holes in the brackets

F. To cut the aluminum profiles, use a miter saw, electric shears or Dremel rotary tool.

G. The systems components should not be cut while installed on the building, unless using a shearing instrument.

H. Provide a 10mm gap between profiles/rails for expansion when multiple lengths of profiles are installed.

3.8 PROTECTION

A. Provide protection of wall assembly from water damage during and after construction

3.9 ADJUSTING

A. Inspect and adjust after installation. Replace or repair defective work.

B. Adjust, and reconfigure as necessary to accommodate cladding system installation. Do not reuse pre-drilled holes unless fastener size is increased.

3.10 SIDING/CLADDING PANEL INSTALLATION

NOTE: Siding/cladding must be installed per manufacturer requirements. {Insert cladding manufacturer installation requirements below}

A. The cavity must be clear for air flow and free from drainage obstructions.

B. Attach cladding per manufacturer requirements into StoVentro T-Profiles and L-Profiles, or other StoVentro profiles to meet the wind loads on the project.

END OF SECTION

SECTION 07 11 13

BITUMINOUS

DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concealed mastic dampproofing.

B. **Related Sections:**
   1. **Section 01 91 19 Building Envelope Commissioning.**

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Indicate properties of products, performance characteristics, proposed use, and certifications that product meets or exceeds standards.

C. Manufacturer's Instructions: Including application instructions, precautions, material safety, and methods of attachment/embedment into substrate data sheets.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Waterproofing Manual, and manufacturer's instructions, whichever are more stringent.

B. For interior and concealed in all applications, provide product certified by manufacturer to be substantially odor-free within 24 hours of application.

1.4 QUALIFICATIONS

A. Applicator Qualifications: Company experienced in application of dampproofing with 3-years' experience on similar sized projects.

1.5 FIELD SAMPLES

A. Provide 4 x 6 foot field sample of mastic dampproofing under provisions of SECTION 01 45 00 - QUALITY CONTROL illustrating application techniques and material thickness.

B. Sample may be incorporated as part of work if approved in writing by Architect.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING PROTECTION.

B. Do not allow products to become frozen.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient and surface temperature above 40°F. for 24 hours before application and continuously until mastic dampproofing has cured.

B. Do not allow dampproofed surfaces to be exposed to prolonged sunlight.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate installation in accordance with SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Do not begin work until substrate preparation is complete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mastic: ASTM D 1227, Type II, Class 1, semi-mastic asphaltic emulsion reinforced with non-asbestos fibers. Product/manufacturer; one of the following:
920AF Fibered Emulsion Mastic; Karnak
Sealmastic; W.R. Meadows, Inc.
MasterSeal 615; Master Builders Solutions by BASF

B. Substitutions: Submit in accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

2.2 ACCESSORIES

A. Mastic Dampproofing:
1. Emulsion Based Dampproofing: Non-asbestos fiber reinforced emulsion asphaltic compound, brush or spray consistency, meeting requirements of ASTM D 1227 or FS-4-1781.
2. Reinforcing Mesh; Treated glass fabric, woven design, 20 x 10 mesh.
3. Plastic Cement: Type recommended by manufacturer and compatible with dampproofing product, for trowel consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

B. Do not apply when surface of ambient temperature is below 40°F., during inclement weather, or if surface is damp, dirty, or dusty.

C. Verify surfaces are solid and free of cracks, pits, rough or sharp projections.

D. Verify items which penetrate surface to receive dampproofing are securely anchored.

3.2 PREPARATION

A. Remove rough or sharp projections, loose particles, and foreign matter detrimental to adhesion and application of dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's written instructions.

C. Apply two coats of plastic cement and one layer of reinforcing mesh (between plastic cement coats) to seal penetrations, small cracks, and at other areas as recommended by manufacturer.

D. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at control joints.

3.3 INSTALLATION

A. Mastic Dampproofing: For application over concealed, concrete surfaces within walls.
   1. Clean surfaces of excess mortar and loose dirt and apply the mastic in two coats by brush or spray. Allow the first coat to dry tacky before applying the second coat.
   2. Coverage shall be approximately 35 sq.ft. per gallon per coat. Fill in crevices and grooves and around projecting anchors and joint reinforcement. Make sure that coating is continuous and free from breaks and pinholes.
   3. At glass-mat gypsum sheathing, apply dampproofing prior to installation of masonry anchors.

3.4 FIELD QUALITY CONTROL

A. Tests: Periodically (not less than once per 100 sq.ft. of surface area) check application thickness to verify compliance with specified thickness. Immediately re-apply if found to be deficient.

B. **Quality Assurance Inspections: Bituminous dampproofing materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.**

3.5 PROTECTION

A. Protect finished installation under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

B. Protect adjacent surfaces not to receive dampproofing against "overspray" or "over brush".

C. Protect dampproofing against damage during backfilling with adhered protection course, neatly fitted around projections and penetrations. Do not apply until dampproofing has thoroughly cured.

D. Protect flashing until placement within wall is complete. Do not allow wind to displace or damage flashing.

3.6 CLEANING

A. Perform final cleaning under provisions of SECTION 01 74 13 - CLEANING.

END OF SECTION

SECTION 07 14 00

FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fluid applied elastomeric waterproofing:
   1. Vertical waterproofing below-grade**.**

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. **Section 01 91 19 - Building Envelope Commissioning**
   3. **Section 07 05 23 - Pressure Testing the Air Barrier System for Air Tightness**

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include membrane thickness, accessories, and method of application.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: This work shall be performed by an experienced applicator who has successfully applied the materials and used the methods specified under similar conditions over a period of at least five years.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the original, sealed containers or unopened packages clearly labeled with the manufacturer's name and the contents.

B. Store materials in a heated and ventilated area located away from all sources of sparks and open flame. Containers of liquid material shall not be left open at any time in the storage area.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Elastomeric Waterproofing: Provide a one-component, moisture-curing, bitumen-modified polyurethane elastomeric waterproofing membrane, containing no coal tar extenders. Provide formulation appropriate for chosen horizontal or vertical installation with associated trowel, squeegee, roller or spray application. Product/manufacturer; one of the following:
   MasterSeal HLM 5000; BASF
   MiraSEAL; Carlisle Coatings & Waterproofing Incorporated (CCW)

B. Flashing Membrane: Provide 1/16" thick neoprene synthetic rubber sheet.

C. Adhesive: Provide neoprene adhesive manufactured expressly for use with the synthetic rubber flashing membrane.

D. Protection Board: Provide a semi-rigid, asphalt saturated board ⅛" thick. Product/manufacturer: Type PC- 2 Protection Course; W.R. Meadows.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose dirt and debris and clean off oil, grease, paint and other foreign contaminants to leave the concrete surface clean and dry. Immediately prior to and during application, remove dirt and dust from the surface with compressed air or a soft broom. Mask with paper and tape the surfaces not designated to receive waterproofing to protect them from accidental application of the waterproofing material.

3.2 INSTALLATION

A. Applying Waterproofing:
1. Select the grade of product that best meets the individual job requirements.
2. Mix the waterproofing compound thoroughly in conformance with the manufacturer's printed instructions.
3. Horizontal Application: Apply product over horizontal surface in one coat using a roller, trowel, or squeegee as required to obtain thickness required. Pour the mixed compound onto the concrete floor and spread out with trowel and squeegee to a thickness of not less than 1/16". Coverage shall be not less than 4 gallons per square.
4. Vertical Application: Apply one coat using a roller, trowel, or squeegee as required to obtain thickness required. Wait for material to film form and become stable between each coat.
5. Install flashing membrane along perimeter walls. Install with adhesive applied to the concrete surface and to the back of the membrane. Press firmly into place without stretching and work out all bubbles, wrinkles and fishmouths. At walls in horizontal application, turn membrane up approximately 3" above the waterproofed surface to form a dam. Lap joints 3" and bond with adhesive.
6. Over flashing membrane, apply a thin coat of neoprene adhesive and allow to dry until tacky before covering with the waterproofing compound. On metal pipes and conduits projecting through the concrete, apply a second coat of waterproofing compound after the first coat has cured. Extend the waterproofing into the floor drain flashing rings.
7. For at least 24 hours after completion of the waterproofing, keep the area clear of all traffic. After testing for leaks, cover the waterproofing with protection board laid with close butt joints and cut to fit around projections and at offsets.

3.3 FIELD QUALITY CONTROL

A. Testing: Floor areas protected with elastomeric waterproofing shall be flood tested for leaks prior to installing the protection board. Plug the floor drains and flood the areas with water to a depth of 2" or more. Allow the water to stand for 24 hours before draining off. Repair all leaks.

B. **Quality Assurance Inspections: Fluid-applied waterproofing materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.**

C. **Film Thickness: Measure film thickness every 100 ft2 during application by using mil-thickness gauge especially manufactured for the purpose.**

D. **Flood Test (for horizontal applications only): After application and curing is complete, perform 24 hour flood test according to ASTM D5957. Plug drains and fill waterproofed area with water to a depth of 2 inches. Test watertightness by measuring water level at beginning and end of the 24 hour period. If water level falls, drain water, allow installation to dry, and inspect. Make repair or replace as required and repeat test. Work shall not proceed before approval of repairs or replacement.**

END OF SECTION

SECTION 07 18 13 - PEDESTRIAN TRAFFIC COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior pedestrian traffic coating system.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include a printed sample of the joint guarantee to be furnished with the accepted coating system.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of traffic coatings required for this Project.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:
   1. Manufacturer's brand name.
   2. Type of material.
   3. Directions for storage.
   4. Date of manufacture and shelf life.
   5. Lot or batch number.
   6. Mixing and application instructions.
   7. Color.

B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40°F., when relative humidity exceeds 85 percent, or when temperatures are less than 5°F. above dew point.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which traffic coating manufacturer agrees to repair or replace traffic coatings that deteriorate within five years from date of substantial

completion.

1. Deterioration of traffic coatings includes the following:
   a. Adhesive or cohesive failures.
   b. Abrasion or tearing failures.
   c. Surface crazing or spalling.
   d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Traffic Coatings: Complying with ASTM C 957.

B. Material Compatibility: Provide primers, base, intermediate, and topcoats; and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.2 PEDESTRIAN TRAFFIC COATING

A. Product/manufacturer: Subject to compliance with requirements, provide one of the following: MasterSeal Traffic 1500; BASF
Pecora Deck 802/804/806 System; Pecora Corporation (Carlisle CCW System) Peda-Gard; Neogard, Division of Hempel

B. Primer: Manufacturer's standard factory-formulated urethane primer recommended for substrate and conditions indicated.

C. Preparatory and Base Coats: Single- or multi-component, aromatic liquid urethane elastomer.

D. Topcoat: Single- or multi-component, aliphatic liquid urethane elastomer. Color shall be Gray.

E. Aggregate: Uniformly graded, washed silica sand of particle sizes, shape, and minimum hardness recommended in writing by traffic coating manufacturer. Spreading rate as recommended by manufacturer for substrate and service conditions indicated, but not less than 8 to 10 lb./100 sq. ft.

2.3 MISCELLANEOUS MATERIALS

A. Joint Sealants: Low modulus unmodified polyurethane based.

B. Adhesive: Contact adhesive recommended in writing by traffic coating manufacturer.

C. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements and for other conditions affecting performance of traffic coatings.

B. Begin coating application only after minimum concrete curing and drying period recommended by traffic coating manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.

C. Verify that substrates are visibly dry and free of moisture. Test for moisture vapor transmission by plastic sheet method according to ASTM D 4263.

D. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Clean and prepare substrates according to ASTM C 1127 and manufacturer's written recommendations to produce clean, dust-free, dry substrate for traffic coating application.

B. Mask adjoining surfaces not receiving traffic coatings, deck drains, and other deck substrate penetrations to prevent spillage, leaking, and migration of coatings.

C. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform profile according to ASTM D 4259. Do not acid etch.
   1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
   2. Remove concrete fins, ridges, and other projections.
   3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
   4. Remove remaining loose material to provide a clean, sound surface.

3.3 TERMINATIONS AND PENETRATIONS

A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at drains and sleeves according manufacturer's written recommendations.

B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrates according to manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks.

3.5 TRAFFIC COATING APPLICATION

A. Apply traffic coating material according to ASTM C 1127 and manufacturer's written recommendations.

B. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated, and omit aggregate on vertical surfaces.

C. Cure traffic coatings according to manufacturer's written recommendations. Prevent contamination and damage during application and curing stages.

3.6 PROTECTING AND CLEANING

A. Protect traffic coatings from damage and wear during remainder of construction period.

B. Clean spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071813

SECTION 07 21 00

BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thermal, acoustical, and fire safing building insulations.

B. Related Sections:
1. Section 03 47 00 - Site Cast Concrete.
2. Section 07 11 00 - Dampproofing.
3. Section 07 22 16 - Roof and Deck Insulation.
4. Section 07 84 00 - Firestopping.

1.2 SUBMITTALS

A. General: Submit following items under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Including performance specifications, composition and applicable standards.

C. Samples: Submit 12" x 12" size samples of each type insulation proposed for use.

D. Manufacturer's Instructions: Written installation instructions, including attachment recommendations.

E. LEED Submittals:
1. Product Data: For adhesives, indicating VOC content
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: (See Articles below for specific products) Dow Chemical Company
Fibrex Co.
Manville Building Materials Marketing Division, Manville Corp., Denver, CO Owens Corning Fiberglas Corp., Toledo, OH
Certainteed Corp., Valley Forge, PA
U.S. Gypsum Co.

2.2 BATT THERMAL INSULATION

A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content.

C. Glass fiber composition, unfaced, minimum one lb./c.f. density, containing no formaldehyde and meeting following standards:
   1. ASTM E 84: FHC 25/50 maximum.
   2. ASTM C 518: R value of 3.2 per inch of thickness.
   3. ASTM C 665: Type I and Type III, Class A.

D. Following products are acceptable:
   1. EcoTouch Pink Fiberglas Insulation by Owens Corning Fiberglas Corp.
   2. Sustainable Insulation, Unfaced Building Insulation by Certainteed Corp.
   3. Unfaced Batts by Manville Corp.

2.3 RIGID INSULATION

A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content.

C. Polyisocyanurate Board: ASTM C 1289, glass-fiber-mat faced, R-Value of 6 per inch, closed-cell, Type II, Class 2. Provide products from one of the following acceptable manufacturers:
   Carlisle Coatings & Waterproofing, Inc.
   Firestone Building Products
   Rmax Operating, LLC

2.4 BATT ACOUSTICAL INSULATION

A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content.

C. Unfaced glass fiber composition, 3½" thick, minimum one lb./c.f. density, meeting following standards:
   1. ASTM E 84: FHC 25/50 maximum.
   2. ASTM C 518: R value of 3.2 per inch of thickness.
   3. ASTM C 665: Type I, Class A.

D. Following products are acceptable
   1. Ecotouch Sonobatts by Owens Corning Fiberglas Corp.
   2. Sustainable Insulation, Sound Control Batts by Certainteed Corp.

2.5 FIRE SAFING INSULATION

A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content.

C. Mineral fiber composition, 4" thick, 4.0 pcf density, meeting following standards
   1. ASTM E 84: FHC 15/10 maximum.
   2. ASTM C 665: Type I, Class A
   3. ASTM E 119: Testing Procedures.
   4. FS HH-I-558B: Class 1 and 2.

D. Following products are acceptable
   1. Thermafiber Safing Insulation by Owens Corning

2. FBX Safing Insulation by Fibrex Co.

2.6 ACCESSORIES

A. Joint Tape: Pressure sensitive type, recommended by insulation manufacturer.

B. Insulation Adhesive:
1. Type recommended by insulation manufacturer.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Stick Clips
1. Galvanized sheet metal with impaling pins and retainer washers.
2. Size and type to suit application and insulation thickness.
3. Approved by manufacturer of insulation for intended use.

D. Stick Clip Adhesive
1. High strength, resilient adhesive, having drying time of 0 to 30 minutes (rapid initial set), and 24 hours final set.
2. Compatible with insulation adhesive, insulation and substrate.
3. Non-corrosive to galvanized steel.

E. Supportive Wire Mesh: Hexagonal design, woven mesh "chicken wire" style.

F. Tie wire: Minimum 18 ga. annealed wire.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive insulation for conditions that will adversely affect the execution and quality of the work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Fit insulation tight within stud spaces, above soffits, behind fascias, and tight to and behind mechanical and electric services within plane of insulation, leaving no gaps or voids. Butt insulation tightly. Cut and fit tightly around items penetrating insulation. Stagger and butt joints, or cavity of a cavity wall system.

B. Install in conformance with the manufacturer's recommendations. Cut material to fit closely around obstructions and projections.
1. Walls: Secure insulation by mechanical means to hold it in place without sagging or slumping. Install insulation with edges and joints butted tight to leave no gaps.
2. Soffits: Insulation shall be laid between wire hangers on back of cement plaster and over cross runners. Sides and ends of adjacent batts shall be tightly butted together.
3. Acoustical Insulation:
   a. Install acoustical insulation between the studs in those gypsum drywall partitions so detailed and noted on the drawings. Staple blankets to the gypsum board or otherwise fasten in place as recommended by the manufacturer of the blankets. Fill all voids.
   b. Where indicated at suspended gypsum board ceilings, lay sound attenuation blankets between wire hangers on back of gypsum board and over cross runners. Do not install on top of or within 3" of light fixtures.

C. Applying Rigid Insulation: Install board insulation at tilt wall panels.
1. Butt panels together for tight fit.
2. Press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3. Securely fasten the board to the backup with mastic and suitable mechanical anchors where required to hold it firmly in place.
4. Cut the material to fit snugly around obstructions and projections. Joints shall be tight.
5. Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

D. Safing Insulation: Compress and install insulation on wire hangers or clips in spaces between floor slabs and curtain walls. Also, in openings in floor slabs to seal around telephone cables, piping, ducts and other utilities per SECTION 07 84 00 - FIRESTOPPING.

3.3 SCHEDULES

A. Provide R values for thermal insulation in locations as follows:
   1. Exterior walls (the following is the minimum required by code; however, reference drawings for thickness required for this project):
      a. Mass: Reference drawings for thickness.
      b. Metal Framed: R13 + R7.5ci
   2. Soffits and fascias: R = 19

B. Provide acoustical insulation in thickness and locations as follows:
   1. Walls: 6" minimum (In areas where shown on drawings)
   2. Above Ceilings: 3½" (In areas where shown on drawings)

END OF SECTION

SECTION 07 22 16
ROOF AND DECK INSULATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Related Work

1. Documents affecting work of this Section include, but are not necessarily limited to, General Requirements / Conditions, Supplementary General Conditions, and Sections in Division 01 of these Specifications.
2. Section 06 10 53 - Miscellaneous Carpentry
3. Section 07 22 16 - Ketone Ethylene Ester Roofing System
4. Section 07 62 00 - Sheet Metal and Miscellaneous Accessories
5. Section 01 91 19 - Building Envelope Commissioning
6. Section 07 05 23 - Pressure Testing the Air Barrier System for Air Tightness

1.2 REFERENCES

A. American Society of Testing Materials (ASTM)

1. C 177-85 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
2. C 209-84 Methods of Testing Insulating Board (Cellulosic Fiber), Structural and Decorative.
3. C 728-89a Perlite Thermal Insulation Board
4. D 41-85 Asphalt Primer Used in Roofing and Waterproofing.
5. D 312-89 Asphalt Used in Roofing.
6. D 1621-73 (1979) Test Method for Compressive Properties of Rigid Cellular Plastics.
7. D 4601-86 Asphalt Coated Glass Fiber Base Sheet Used in Roofing.

B. National Roofing Contractors Association (NRCA)

1.3 QUALITY ASSURANCE

A. Regulatory Requirements

Classified by Underwriter's Laboratories (UL) as Class A roof covering. Follow local, state, and federal regulations, safety standards, and codes.

B. Installation

1. Installation shall be in accordance with manufacturer's current published application procedures, NRCA general recommendations, and ASCE 7 wind uplift criteria.
2. Roof system manufacturer's technical specifications shall be considered part of this specification and shall be used as reference for specific application procedures.

1.4 SUBMITTALS

A. Product Data: Submit Manufacturer's product data sheets for each product.

B. Shop Drawings: Layout of roof plan showing tapered design, tapered insulation pattern, direction of slope, amount of slope, spot elevations indicating thicknesses at high and low points.

C. Certification: Submit roof manufacturer's certification in writing that insulation is acceptable as substrate for application of specified roof system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufacturer's recommendations.

B. When stored outdoors:
1. Tarp and shield insulation from moisture and ultraviolet rays.
2. Elevate insulation above substrate four-inch minimum.
3. Secure insulation to resist high winds.
4. Distribute insulation stored on roof deck to prevent concentrated loads that would impose excessive stress or stain on deck or structural members. Verify that structure can accommodate additional loading.
5. Wet insulation, or insulation that has been wet but which has dried, may not be used and shall be removed completely and immediately from the job site.
6. Do not double stack bundles of insulation on the roof top.

1.6 SEQUENCING AND SCHEDULING

A. Substrate Acceptance: Roof system manufacturer's representative shall inspect roof deck and associated substrates and provide written acceptance of conditions.

B. Manufacturer's approved roofing contractor shall inspect and approve deck and substrates.

C. Plan roof layout with respect to roof deck slope to prevent rainwater drainage into completed roofing.

D. Do not install more insulation than can be covered with complete roof system in same day.

1.7 PRODUCT CONDITIONS

A. Environmental Requirements:
1. Apply roofing and insulation in dry weather.
2. Do not proceed with roof construction during inclement weather or when precipitation is predicted 40% or more possibility.
3. Do not apply insulation over wet or moist deck or in foggy conditions.
4. Days with wind speeds of 30 mph or greater shall be considered "Bad Weather" days.

B. Emergency Equipment: Maintain on-site equipment and material necessary to apply emergency temporary seals I the event of sudden storms or inclement weather.

C. Costs for emergency roofing shall be borne by Contractor.

PART 2 – PRODUCTS

2.1 INSULATION

A. All insulation shall be approved in writing by the membrane manufacturer as to thickness, type, and manufacturer. All insulation must be approved for the specific application, Underwriters Laboratory approved, and be listed in the FM Global Approval Guide.

B. Polyisocyanurate Roof Insulation: Insulation shall be two layers of rigid polyisocyanurate foam board; meeting Federal Specification No. HH-I-1972/1 or 2 with 20 psi minimum compressive strength and 2.0 pcf minimum density. First layer shall be a minimum thickness of one and one-half inch (1-1/2"). Average R-value over each roof area shall meet or exceed R-25. Board shall be surfaced on two (2) sides with non-asphaltic facer material.

C. Factory Tapered Polyisocyanurate for Field of Roof: Shall be tapered polyisocyanurate board, with a 20 psi minimum compressive strength and nominal 2.0 pcf density. Insulation shall be of thickness required for one-fourth inch (1/4") slope per foot to roof drains as shown on drawings with a minimum edge thickness of one and one-half inch (1-1/2"). Minimum R-value over each roof area shall meet or exceed R-25. Insulation shall be surfaced on two (2) sides with a non-asphaltic facer material.

D. Factory Tapered Polyisocyanurate Crickets: Factory cut twenty-four inch by forty-eight inch (24" x 48") polyisocyanurate board cut to one-half inch (1/2") per foot slope used in conjunction with standard thickness of polyisocyanurate board to provide positive slope.

E. Substrate Board: Impact-resistant, nonstructural, specially engineered gypsum and cellulose fiber panels with 95% recycled content; uniform water-resistance throughout core and surface. Board size four feet by eight feet (4' x 8'), thickness 1/2"; conforming to ASTM C 1278, meeting FM 4470 Class 1 criteria, classified by Underwriters Laboratories, and listed in the FM Global Approval Guide. Board will meet the following physical properties, Securock® Roof Board, as manufactured by USG Corporation, or approved equal

2.2 BITUMEN

A. Shall be ASTM D 312 Type IV extra steep asphalt.

2.3 ASPHALT ROOF PRIMER

A. Quick-dry asphalt-based primer for priming of asphalt roof surfaces, Handi-Gard RC-114, as manufactured by Gibson Homans Company / GAF, or approved equal.

Applicable Federal Specification	SS-A-701B
ASTM	D 41
Flash Point	105° F
Viscosity at 80° F (ASTM D 217)	50-60 K.U.
Weight per gallon	7.4 pounds
Drying time (to touch)	Min. 4 hours

2.4 FASTENERS

A. Fasteners and fastening plates and/or termination bars shall be FM Approved and shall be listed in the FM Global Approval Guide, and as recommended by the insulation/ fastener manufacturer for the specific application to meet the minimal requirements for wind uplift as required by the local jurisdiction and/or FM Global.

B. Heavy Duty Fastener for Steel Applications for 18-22 gauge Steel Substrates: Shall be a #14 fastener with a minimum .190 diameter shank and a thread diameter of .245 with ten (10) threads per inch and a 30 degree spade point. Fasteners shall be fluorocarbon coated with CR-10 corrosion resistant coating when subjected to 30 Kesternich cycles (DIN 50018) shows less than 15% red rust which surpasses FM Global Approval Standard 4470, as manufactured

by OMG Roofing Products, Agawam, MA or approved equal. All fasteners shall be used in conjunction with the manufacturers approved round pressure plate. Fasteners, plates, and/or bars shall be FM approved and listed in the FM Global Approval Guide.

PART 3 – EXECUTION

3.1 PROTECTION

A. Provide special protection from traffic on yet to be removed roofing.

B. Provide special protection from traffic on completed work.

3.2 EXAMINATION AND PREPARATION

A. Do not install until defects are corrected and deck substrate meets roof system manufacturer's requirements.

B. Do not apply insulation unless asphalt application temperature, EVT of approximately 375 degrees F to 425 degrees F, can be maintained or when water or moisture is present on substrate. Do not heat asphalt above flashing point, or 525 degrees F.

C. Examine substrate and related surfaces, and verify that there are no conditions such as inadequate anchorage, foreign materials, moisture, ridges, depressions, or other conditions which would prevent satisfactory installation of roof system.

D. Start of work constitutes acceptance of deck substrate and site conditions.

E. Sweep deck substrate clean of dust and debris immediately prior to installation of tapered insulation.

3.3 INSULATION

A. Manufacturer's Instructions: In regard to attachment, the manufacturer's instructions or specifications shall determine the suitability for an application. Installation must meet ASCE 7 criteria and meet local governing building codes.

B. Precautions: The surface of the insulation must not be ruptured due to overdriving of fasteners.

C. Thermal insulation boards shall be laid on the substrate in parallel rows with end joints staggered and butted as close as possible. All joints shall be tight and at the roof perimeter and roof penetrations, insulation shall be cut neatly and fitted to reduce openings to a minimum. All openings one-fourth inch (1/4") or larger shall be filled with insulation.

D. Insulation shall be tapered or feathered at drains and scuppers to provide proper drainage (if applicable).

E. No more insulation shall be installed than can be covered by the completed roof system by the end of the day or the onset of inclement weather.

F. Tapered insulation and crickets, when specified, shall be placed in accordance with the drawings and/or as required to minimum of NRCA standards.

3.4 MECHANICALLY FASTENED INSULATION

A. Specified insulation shall be mechanically fastened to conform to the ASCE 7 criteria for wind uplift as dictated by wind zone applicable to location of project. Fasteners and fastening patterns shall be determined by building height, location and geographical area of the United States. It is the contractor's responsibility to consult current publications, literature, and bulletins of IBC and the manufacturer that are in effect at the time of this project. Boards shall be staggered and butted as close as possible with voids over one-fourth inch (1/4") to be filled.

B. Insulation shall be laid with edges parallel to flutes and bearing on deck surface/flats. The long dimension of base insulation layer must be fully supported by the top flange of the metal deck. The edges of insulation boards must not cantilever over the flutes of the metal deck.

C. The top surface of the first layer of insulation shall be coated with hot asphalt using twenty-five pounds (25#) per one hundred (100) square feet of surface, and a second layer of insulation shall be applied using offset joints, so that each layer breaks joints to a minimum of six inches (6") both ways with the preceding layer, and immediately walked in place.

D. Where noted on drawings fully adhere a second layer of tapered insulation mopped over the base layer as follows: The top surface of the first layer of insulation shall be coated with hot asphalt using twenty-five pounds (25#) per one hundred (100) square feet of surface, and a one-eighth inch (1/8") tapered layer of insulation shall be applied using offset joints, so that each layer breaks joints to a minimum of six inches (6") both ways with the preceding layer, and immediately walked in place.

3.5 SUBSTRATE BOARD

A. The top surface of the previous layers of insulation shall be coated with hot asphalt using twenty-five pounds (25#) per one hundred (100) square feet of surface, and a top layer of substrate shall be applied using offset joints, so that each layer breaks joints to a minimum of six inches (6") both ways with the preceding layer, and immediately walked in place.

3.6 ADJUSTING

A. Remove insulation which has been damaged (broken, cracked, punctured, wet, etc.) and install acceptable new units before installation of roof system.

3.7 CLEANING

A. Remove debris and material wrappers from jobsite. Leave insulation clean and dry, ready to receive roofing membrane.

3.8 PROTECTION

A. Provide special protection from traffic on completed work.

3.9 FIELD QUALITY CONTROL

A. Quality Assurance Inspections: Roof and deck insulation materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.

B. Testing Agency: Engage a qualified testing agency to perform evaluation of installed thermal barrier per ASTM C1153 Infrared Thermal Analysis of Insulation Installation

and ASTM C1060 Evaluation of Moisture in installed Insulation.

END OF SECTION 07 22 16

SECTION 072419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. EIFS - Provide air and moisture barrier, and compatible EIFS for vertical above grade exterior walls.
2. Foam Shapes
3. Lite Cast Stone

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **Project site**.

1.3 SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory**, including water-resistive coatings**.

B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer certificates.

B. Product certificates.

C. Product test reports.

D. Evaluation reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Manufacturer Requirements

1. Member in good standing of the EIFS Industry Members Association (EIMA)
2. Air/moisture barrier and EIFS manufacturer for a minimum of thirty (30) years
3. Manufacturing facilities ISO 9001:2008 Certified Quality System and ISO 14001:2004 Certified Environmental Management System

D. Contractor Requirements

1. Engaged in application of similar systems for a minimum of three (3) years
2. Knowledgeable in the proper use and handling of Sto materials

PART 2 - PRODUCTS (EIFS SYSTEM)

2.1 MANUFACTURERS

A. Provide Air/Moisture Barrier and EIFS coatings and accessories from single source manufacturer or approved supplier.

B. The following are acceptable manufacturers:

1. Sto Corp. – Air/Moisture Barrier, EIFS
2. Plastic Components, Inc. – EIFS Accessories
3. Dryvit - EIFS
4. Parex - EIFS

2.2 PERFORMANCE REQUIREMENTS

A. Comply with ASTM E 2570 (Air/Moisture Barrier) and ASTM E 2568 (EIFS)

B. Table 1 Air/Moisture Barrier Performance

TEST	METHOD	CRITERIA	RESULT
1. Weathering	AATCC 127 (Water Column)	No cracking, bond failure or water penetration after 210 hours UV exposure, 25 wet/dry cycles, and 21.6 in (55 cm) water column	Pass
2. Durability	ASTM E 1233 / ASTM E72 / ASTM E 331	No cracking or water penetration at sheathing joints after 10 cycles transverse loading, 1 cycle racking, 5 cycles environmental conditioning, and 15 minutes water spray at 2.86 psf (137 kPa) pressure differential	No cracking or water penetration
3. Water Resistance	ASTM D 2247	Absence of deleterious effects after 14 day exposure	No deleterious effects

TEST	METHOD	CRITERIA	RESULT
4. Water Vapor Transmission	ASTM E 96 Method B (Water Method)	Measure	Sto Gold Fill®: 7.10 perms [408 ng/(Pa·s·m^2)] Sto Gold Coat: > 10 perms [574 ng/(Pa·s·m^2)] Sto AirSeal: > 12 perms [689 ng/(Pa s m^2)]
5. Air Leakage (material)	ASTM E 2178	≤ 0.004 cfm/ft2 at 1.57 psf (0.02 L/s•m2 at 75 Pa)	Pass
6. Air Leakage (assembly)	ASTM E 2357	≤ 0.04 cfm/ft2 (0.2 L/s•m2)	Pass[1]
7. Freeze-Thaw	ASTM E 2485	No delamination or surface changes after 10 cycles when viewed under 5X magnification	No delamination or surface changes
8. Surface Burning	ASTM E 84	Flame Spread less than or equal to 25 Smoke developed less than or equal to 450	Flame Spread: <25 Smoke Density: <450
9. Tensile Bond	ASTM C 297	Greater than 15 psi (103 kPa)	Pass over Plywood, OSB, Glass Mat Faced Gypsum sheathings, CMU

1. Based on testing of air barrier joint treatment material at sheathing joints and no top coat

Table 2 EIFS Weather Resistance and Durability Performance*

TEST	METHOD	CRITERIA	RESULTS
1. Accelerated Weathering	ASTM G 153 (Formerly ASTM G 23)	No deleterious effects* at 2000 hours when viewed under 5x magnification	Pass
2. Accelerated Weathering	ASTM G 154 (Formerly ASTM G 53)	No deleterious effects* at 2000 hours	Pass
3. Freeze/Thaw Resistance	ASTM E 2485	No deleterious effects* at 10 cycles when viewed under 5x magnification	Pass
4. Water Penetration	ASTM E 331 (modified per ICC-ES AC 235)	No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes at 6.24 psf (299 Pa) or 20% of design wind pressure, whichever is greater	Pass at 12.0 psf (575 Pa) after 30 minutes
5. Drainage Efficiency	ASTM E 2273	90% minimum	> 90%
6. Tensile Adhesion	ASTM E 2134	Minimum 15 psi (103kPa) tensile strength	Pass
7. Water Resistance	ASTM D 2247	No deleterious effects*at 14 day exposure	Pass @ 28 days
8. Salt Spray	ASTM B 117	No deleterious effects* at 300 hours	Pass @ 300 hrs
9. Abrasion Resistance	ASTM D 968	No cracking or loss of film integrity at 528 quarts (500 L) of sand	Pass @ 528 quarts (1000 L)

TEST	METHOD	CRITERIA	RESULTS
10. Mildew Resistance	ASTM D 3273	No growth supported during 28 day exposure period	Pass @ 28 days
11. Impact Resistance	ASTM E 2486	Standard: 25-49 in-lbs (2.83-5.54J) Medium: 50-89 in-lbs (5.65-10.1J) High: 90-150 in-lbs (10.2-17J) Ultra-High: >150 in-lbs (>17J)	Pass with one layer Sto Mesh Pass with two layers Sto Mesh Pass with one layer Sto Intermediate Mesh Pass with one layer Sto Armor Mat and one layer Sto Mesh

* No deleterious effects: no cracking, checking, crazing, erosion, rusting, blistering, peeling or delamination

Table 3 Air/Moisture Barrier and EIFS Fire Performance

TEST	METHOD	CRITERIA	RESULT
1. Fire Endurance	ASTM E 119	Maintain fire resistance of existing rated assembly	Pass (4 inch [102 mm] maximum allowable insulation thickness)
2. Intermediate Scale Multi-Story Fire Test	NFPA 285 (formerly UBC Standard 26-9)	1. Resistance to vertical spread of flame within the core of the panel from one story to the next 2. Resistance to flame propagation over the exterior surface 3. Resistance to vertical spread of flame over the interior surface from one story to the next 4. Resistance to significant lateral spread of flame from the compartment of fire origin to adjacent spaces	Pass with 12 inches (305 mm) insulation
3. Radiant Heat Ignition	NFPA 268	No ignition @ 20 minutes	Pass with 1 and 12 inches (25 and 305 mm) insulation
4. Surface Burning (individual components)	ASTM E 84	Individual components shall each have a flame spread of 25 or less, and smoke developed of 450 or less	Flame Spread: < 25 Smoke Developed: < 450

Table 4 EIFS Component Performance

TEST	METHOD	CRITERIA	RESULT
1. Alkali Resistance of Reinforcing Mesh	ASTM E 2098	Greater than 120 pli (21 dN/cm) retained tensile strength	Pass
2. Requirements for Rigid PVC Accessories	ASTM D 1784	Meets cell classification 13244C	Pass

2.3 AIR AND MOISTURE BARRIER

A. StoGuard® or similar approved
   1. Joint Treatment, Rough Opening Protection, and Detail Components
      a. Basis of Design: Sto Gold Coat® - ready mixed coating applied by brush, roller or spray for rough opening protection of frame walls and joint treatment of sheathing when used with StoGuard Fabric. Also used as a detail component with StoGuard Fabric to splice over back flange of starter track, flashing, and similar ship lap details
   2. Waterproof Coating
      a. Basis of Design: Sto Gold Coat® – ready mixed waterproof coating for concrete, concrete masonry, wood-based sheathing, and glass mat gypsum sheathing

   3. Transition Membrane: Basis of Design: StoGuard Transition Membrane – flexible air barrier membrane for continuity at transitions such as sheathing to foundation, dissimilar materials (CMU to frame wall), wall to balcony floor slab or ceiling, flashing shingle lap transitions, floor line deflection joints, masonry control joints, and through wall joints in masonry or frame construction.

2.4 ADHESIVE

A. Basis of Design: Sto Primer Adhesive-B – factory blended one-component polymer-modified portland cement based adhesive.

2.5 INSULATION BOARD

A. Basis of Design: Sto EPS Insulation Board: nominal 1.0 lb/ft^3 (16 kg/m^3) Expanded Polystyrene (EPS) insulation board in compliance with ASTM E 2430 and ASTM C 578 Type I requirements and listed, labeled, and furnished in accordance with Section 1.6C.

2.6 BASE COAT

A. Cementitious Base Coat
   1. Basis of Design: Sto Primer/Adhesive-B – factory blended one component polymer modified portland cement based base coat. Also used as a leveler for concrete and masonry surfaces

2.7 REINFORCING MESHES

A. Standard Mesh
   1. Basis of Design: Sto Mesh – nominal 4.5 oz/yd^2 (153 g/m^2), symmetrical, interlaced open-weave glass fiber fabric made with alkaline resistant coating for compatibility with Sto materials

B. High Impact Mesh. (FROM FINISHED FLOOR TO 4’-0” A.F.F.)
   1. Basis of Desing: Sto Intermediate Mesh – nominal 11.2 oz./yd^2 (380 g/m^2), high impact, interwoven, open weave glass fiber fabric with alkaline resistant coating for compatibility with Sto materials

2.8 PRIMER

A. Basis of Design: StoPrime Sand – acrylic based tintable primer with sand for roller application

2.9 FINISH COAT (AT FLAT WALL SURFACES)

A. Basis of Design: Sto Essence DPR Finish – acrylic based textured wall finish with graded marble aggregate.
   1. Colors: **As selected by Architect from manufacturer's full range**
   2. Texture: R1.5 SWIRL, Standard finish

2.10 Lite Cast Stone

A. Provide Lite Cast Stone from single manufacturer or approved supplier.

B. The following are acceptable manufacturers:
   1. Basis of Design: Vefo Inc. Precision Foam Shape products

C. PERFORMANCE REQUIREMENTS
   1. Lite Cast Stone Product.
      a. 5/8" Cast-Concrete layer
      b. Foam Insert
      c. Foam ledger
      d. Concrete return at backside.
   2. Color: Clay (to be selected by Architect from manufacture's full range)
   3. Foam Specifications to meet requirements below (FOAM SHAPES) or EIFS manufacture minimum standards.

2.11 Foam Shapes

A. Provide foam from single manufacturer or approved supplier

B. The following are acceptable manufacturers:
   1. Vefo Inc. Precision Foam Shape products
   2. Or Approved equal that can factory apply base coat

2.12 PERFORMANCE REQUIREMENTS

A. Foam Shapes.
   1. Foam shape cut to Architect specifications.
      a. EPS29 Type IX (For Typical Foam Shapes)
         1) Light weight, closed cell ridged insulation, manufactured from expanded polystyrene (EPS) Foam to meet or exceed ASTM C578, Type IX Standard Specification for Rigid, Cellular Polystyrene thermal insulation.
            a) Nominal Density: 2.0 ASTM C303
            b) Thermal Resistance: R-Value per inch at 25degree F=5 ASTM C518 or C177
            c) Water Vapor Permeability: 2.5 perms ASTM E96
            d) Water Absorption: 2.0 ASTM C272

e) Oxygen Index: 24% ASTM D 2863
f) Compressive Strength @10% deformation, min: 25-33 ASTMD1621
g) Flexural Strength: 50 psi, ASTM C203
h) Dimensional Stability: 2.00% ASTM D2126
i) Flame Spread: <20 ASTM E84
j) Smoke Developed: 150-300 ASTM E84

b. EPS22 Type II (For all large foam shapes)
1) Light weight, closed cell ridged insulation, manufactured from expanded polystyrene (EPS) Foam to meet or exceed ASTM C578, Type II Standard Specification for Rigid, Cellular Polystyrene thermal insulation.
a) Nominal Density: 1.5 ASTM C303
b) Thermal Resistance: R-Value per inch at 25degree F= 4.76 ASTM C518 or C177
c) Water Vapor Permeability: 3.5 perms ASTM E96
d) Water Absorption: 3.0 ASTM C272
e) Oxygen Index: 24% ASTM D 2863
f) Compressive Strength @10% deformation, min: 15-21 ASTMD1621
g) Flexural Strength: 35 psi, ASTM C203
h) Dimensional Stability: 2.00% ASTM D2126
i) Flame Spread: <20 ASTM E84
j) Smoke Developed: 150-300 ASTM E84

2. Base coat of Foam Shapes.
a. Factory applied.
b. Troweled directly onto foam shape.
c. Base coat to meet EFIS manufacture standards
3. Mesh:
a. Embedded fiberglass or Polypropylene mesh into base coat.
b. High impact resistant mesh to all shapes 0 feet to 4 feet A.F.F. Or Double application of mesh is acceptable if high impact mech can not be formed to shape.
c. High impact and standard mesh to meet EIFS manufacture standards.
d. Allow minimum of 2” of extra mesh around edges of all foam shapes.

PART 3 - EXECUTION

3.1 EIFS INSTALLATION

A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

B. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, **at windowsills,** and elsewhere as indicated. Coordinate with installation of insulation.

C. Board Insulation: Adhere insulation to substrate in compliance with ASTM C 1397 and the following:

1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.
2. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier.

D. Expansion Joints: Install at locations indicated and where required by EIFS manufacturer.

E. Waterproof Adhesive/Base Coat: To exposed surfaces of insulation, apply in minimum thickness recommended in writing by EIFS manufacturer over **sloped surfaces**, **windowsills**, **parapets**, **foam build-outs**.

F. Base Coat: Apply to exposed surfaces of insulation a**nd foam build-outs** in minimum thickness recommended in writing by EIFS manufacturer.

G. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

H. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.

I. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide, strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

J. Foam Build-Outs: Fully embed reinforcing mesh in base coat.

K. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

L. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.

M. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

3.2 LITE CAST STONE INSTALLATION

A. Most Horizontal Runs

1. Remove foam ledger from product and adhere to brown coat with akroflex styroglue. This adhesive should be applied with a ¼” notched towel to create air pockets. This allows adhesive to properly cure. Allow adhesive to cure 24 hours before attaching lite-cast details.
2. Apply the akroflex styroglue to the back side of the lite-cast and to the preciously installed ledger with the same ¼” notched trowel. Proceed by hanging the detail over the ledger and allowing it to cure for 24 hours.
3. At the same time detail section are being hung apace a ¼” between each piece for grout seam. Frist mix grout material with add mix to a dry pack consistency using a small paint brush apply admix to inside side of grout seam. Next, pack joints tightly leaving a ¼” depth remaining. Allow to cure 24 hours. Apply second application to remaining ¼” depth

again packing tightly. Quickly remove any excess grout that may be on the material as to not discolor or stain the product.

B. Most Vertical Runs

1. Start from bottom up, (example: install window sill first) insert ¼" spacer between pieces. Small details often can be held in place with construction tape. Larger detail might require a nail or screw at a ¾" depth not penetrate water proof barrier. Allow adhesive to set. Mechanical fasteners are not required for lite cast products. For very large detail, other fastening methods may be required.

3.3 FOAM SHAPE INSTALLATION

1. Foam is attached to the brown coat using the synthetic wall system base coat material as an adhesive, and allowed to dry for 24 hours. For larger foam details provide mechanically attached ledger.
2. Apply finish coat to foam shape per EIFS manufactures recommendations

END OF SECTION 072419

Building with conscience.

StoTherm® ci over Steel Frame

Design Guide and Detail Booklet

Series 52s.xx | April 2024

Facades

Exterior Wall Insulation Systems

Combining innovative design and high-level performance, StoTherm®ci over steel frame offers a unique approach to wall system design. A highly efficient and cost-effective solution to bolster an architect's aesthetic vision StoTherm®ci wall system provides world class performance through the integration of continuous insulation (ci), innovative air and water-resistant barrier technology, drainage and a variety of architectural surface options. They are easy to install and can be used in almost any residen-tial or commercial setting.

Design Guide

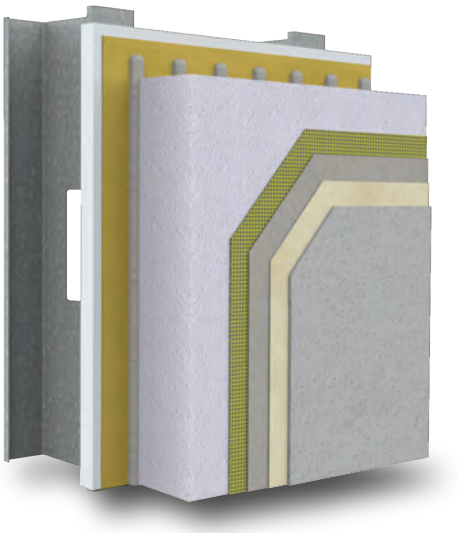
Table of Contents

System Overview 3
System Components 3
Assembly Diagram 6
General Notes 6
StoGuard Product Use Chart 11
Additional Information 12
Guide Details 13

ATTENTION

The final design of any project is the sole responsibility of the Design Professional, with considerations for compliance with local building and design codes and requirements. Sto Corp. accepts no liability for design, engineering, or workmanship of any project. The information provided herein is in addition to other technical data provided by Sto Corp. (System Bulletin, Specification, Guide Details, etc). For more information, please visit www.stocorp.com

Sto Corp.
3800 Camp Creek Pkwy. SW
Bldg. 1400 • Suite 120
Atlanta, GA 30331
Tel: (800) 221-2397
Fax: (404) 346-3119
http://www.stocorp.com
helpdesk.stocorp.com



StoTherm®ci

StoTherm ci is an exterior insulation and finish system (EIFS) for use on vertical above grade exterior walls. It incorporates an air and water-resistive barrier (AWRB), and continuous exterior insulation attached with vertical ribbons of adhesive to the AWRB, which forms a drainage cavity. An impact resistant reinforced base coat is installed over the continuous insulation, which serves as a base for Sto high performance textured finishes, StoCast finishes that simulate the look of wood, brick, stone, and other architectural finish materials, or Sto Specialty finishes that create unique architectural surfaces.

NOTE: Sto documents referenced in this booklet are in **bold** and can be viewed or downloaded by visiting the documentation center at www.stocorp.com, where other information - Guide Specification, System Bulletin, and Product Bulletins – is also available.

Fluid-Applied Membranes

Sto Gold Coat® - Spray or roller applied vapor-permeable air and water-resistive barrier for use behind most claddings and as part of StoTherm ci, StoPowerwall, StoQuik and StoVentec systems.

Sto Gold Coat® TA - Trowel applied vapor-permeable air and water-resistive barrier for use with StoTherrm ci, StoPowerwall and StoQuik systems.

Sto AirSeal® - Spray or roller applied vapor-permeable air and water-resistive barrier for use behind most claddings and as part of StoTherm ci, StoPowerwall, StoQuik and StoVentec systems.

StoGuard VaporSeal® - Spray or roller applied Class 1 vapor retarder. Also functions as an air and water-resistive barrier for use behind most claddings and as part of StoTherm ci, StoPowerwall, StoQuik and StoVentec systems.

Detail Component Products

Sto RapidGuard® - One component air barrier and waterproof material used to protect rough openings, sheathing joints, seams, cracks, penetrations, and other transitions in above grade wall construction.

StoGuard® Conformable Membrane - A versatile, easy to install membrane that simplifies detailing of transitions for air barrier continuity in Sto proprietary wall systems and other wall assemblies.

StoGuard® Fabric - Non-woven cloth reinforcement used to treat sheathing joints and rough openings when embedded in Sto Gold Coat, Sto AirSeal or StoGuard VaporSeal.

Continued on next page

Detail Component Products (cont'd)

StoGuard® RediCorner - A preformed StoGuard® fabric piece used in the corners of rough openings for quicker installation.

Sto Gold Fill® - Trowel applied compound used with StoGuard Mesh or StoGuard Detail Mesh to treat rough openings and sheathing joints.

Sto Mesh, Sto Mesh 6oz., Sto Intermediate Mesh & Sto Detail Mesh - A variety of designed coated glass fiber meshes used to provide reinforcement and impact resistance in Sto claddings.

Sto Armor Mat & Sto Armor Mat XX - A heavy, specifically designed coated glass fiber mesh used to provide ultra-high impact resistance in Sto claddings.

StoGuard® Transition Membrane - Flexible air barrier material used to make connections with adjoining construction and dissimilar materials, and to bridge dynamic joints.

Insulation Adhesive

Sto TurboStick® and StoTurboStick®Mini - is a ready-to-use, single component polyurethane foam adhesive used for securing insulation panels to the substrate and filling seams and gaps in insulation board surface.

Sto EPS Insulation Board: Expanded polystyrene insulation (EPS) board in compliance with ASTM E2430 and ASTM C578, Type I.

Fireblocking

Sto Lamella - is a non-combustible mineral wool fireblocking product that is code compliant for wall covering over gypsum sheathing on steel frame wall construction based on testing in accordance with NFPA 285.

Base Coats/Adhesive

Sto BTS® Plus - A trowel or spray applied, one-component, polymer-modified, high build cement based, dry powder material used as an adhesive and base coat.

Sto BTS® Xtra - A trowel or spray applied, lightweight factory blended one component polymer modified portland cement based extra high build base coat.

Sto Primer/Adhesive - A two-component polymer modified, trowel applied base coat consisting of an acrylic admixture mixed with Type I portland cement.

Sto Primer/Adhesive-B - A trowel or spray applied, one-component, polymer-modified, cement based, dry powder material used as a base coat.

Continued on next page

Base Coats/Adhesive (cont'd)

Sto RFP - A trowel or spray applied, ready mixed acrylic based fiber reinforced base coat material used as an adhesive and base coat.

Sto Flexyl - A trowel or spray applied, ready mixed acrylic based fiber reinforced base coat material used as an adhesive and base coat.

Sto Watertight Coat - A trowel or spray applied waterproofing membrane with a low vapor permeability based on a unique combination of acrylic emulsion, Portland cement and fine fibers.

Strike Defense

StoArmat Classic Plus - A trowel or spray applied, cement-free high build acrylic-based plaster material used with Sto Mesh to form Sto Strike Defense.

Primer

StoPrime® Sand - A roller, brush or sprayed applied, tintable, sanded primer used to reduce surface water absorption of the base coat, and to enhance finish color, texture, and coverage of finishes.

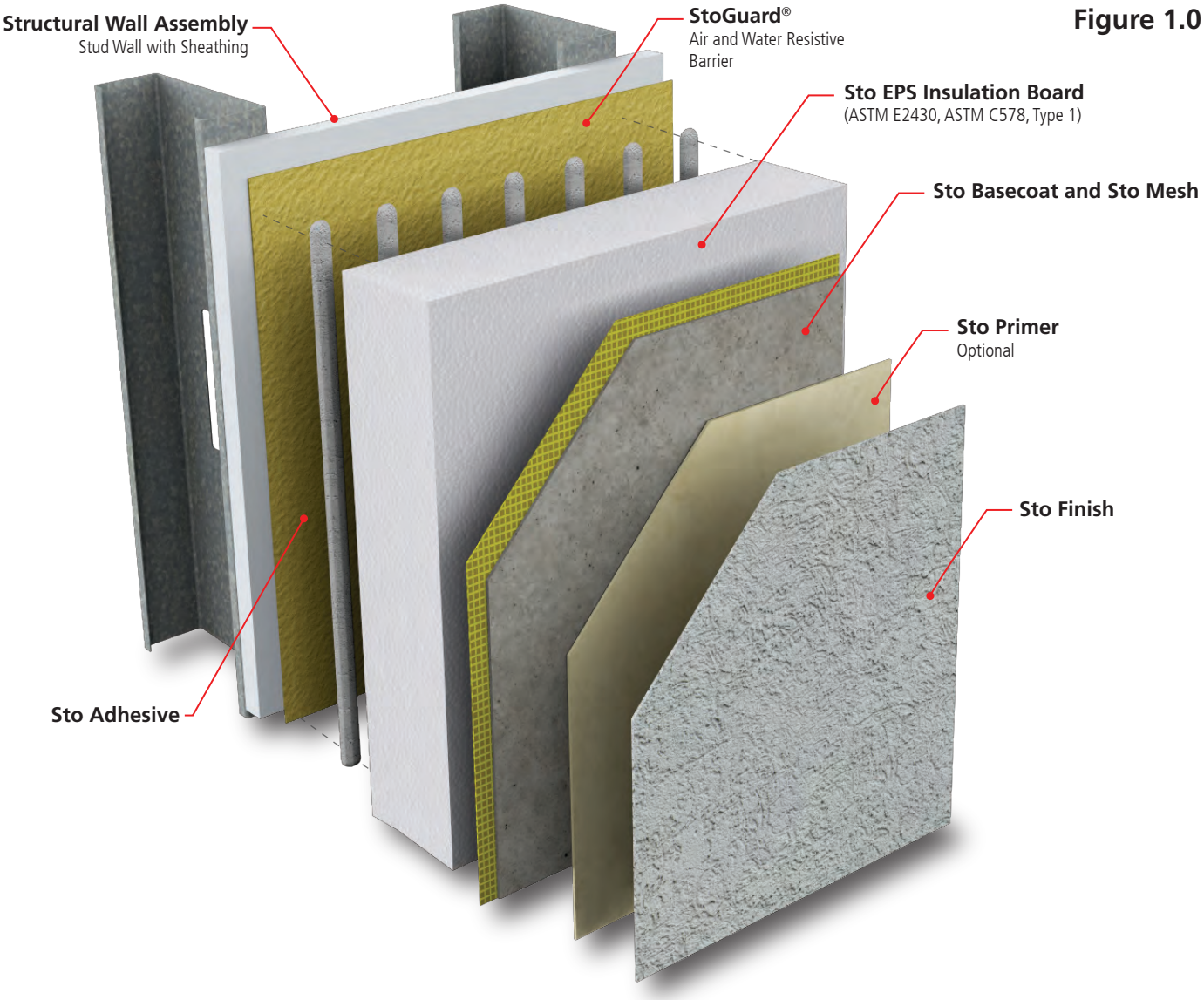
StoPrime® - A roller, brush or sprayed applied, tintable, used to reduce surface water absorption of the base coat, and to enhance finish color, texture, and coverage of finishes.

Finishes

StoLit® Lotusan® - A trowel or sprayed applied, ready-mixed, acrylic-based wall finish with Lotus-Effect® Technology for highest water repellency and resistance to soiling. Available in a variety of graded marble aggregates, as well as standard and specialty textures.

NOTE: Please visit www.stocorp.com for more information on a wide range of available Sto Finish options for StoTherm®ci including; StoSignature, StoCast (Wood and Brick), Stolit®, Stolit® X, Sto Powerflex, StoPowerwall®, Sto Essence DPR, and Sto Powercryl finishes.

Figure 1.0



Structural Considerations

1. StoTherm® ci is a non-structural exterior wall cladding. It is non-load bearing and does not provide racking resistance, nor is it to be used as a base for mechanical anchoring of attachments such as signage or light fixtures. The structural backup wall, typically concrete, concrete masonry, or a frame wall with sheathing, must be designed and built for these purposes in accordance with the applicable building code.

2. Wind Loads: Design deflection criteria for StoTherm® ci is L/240. StoTherm® ci transfers positive wind loads to the supporting wall construction and resists negative wind loads via adhesive attachment to a substrate.

Generally, StoTherm® ci is not the determinant of ultimate wind load capacity on frame walls. The supporting frame wall construction, or sheathing attachment, typically dictates ultimate load capacity of the assembly. Consult ICC ESR-1748 for allowable wind loads (published values have a safety factor of 3x applied to ultimate loads). In some cases, such as painted wall substrates, where adhesion may not be possible, full mechanical attachment is necessary. Refer to ICC ESR-1030 for information on allowable wind loads of mechanically attached StoTherm® ci systems.

Continued on next page

Fire Protection

StoTherm®ci uses combustible foam plastic insulation as its insulating component. Use of foam plastics on exterior walls is covered in Chapter 26 of the IBC (International Building Code), which requires certain tests to allow use of foam plastics on noncombustible construction. Based on testing of StoTherm® ci in accordance with NFPA 285 and NFPA 268 (and other fire tests and criteria listed in the code), the system complies with requirements for use on noncombustible construction (Types I, II, III, and IV). The system may also be used on combustible (Type V) construction.

Where a fire resistance rating is required, in general, StoTherm®ci does not add to nor detract from the rating of an hourly rated load bearing or non-load bearing concrete, concrete masonry, or steel frame base wall assembly, based on testing in accordance with ASTM E119.

Refer to ICC ESR-1748 for more information on tested assemblies. Note that certain assemblies may be extended beyond the recognition provided in the ICC evaluation report through engineering judgments on file at Sto Corp., or by way of modeling or rational analysis applied to the particular product or assembly in question.

See Section 2.5 of Sto specification 5200 for fireblocking requirements of the 2022 New York City Building Code.

Moisture Protection

1. General: StoTherm®ci has redundant built-in moisture protection with StoGuard®, the air and water-resistive barrier component in the assembly. StoGuard® is applied to the structural backup wall and protects against water damage from rain during construction when the building is "closed-in," and in the event of a breach in the wall cladding while in service. StoGuard® is available as a vapor permeable or vapor impermeable fluid-applied membrane.

   The system also has built-in drainage capability. When properly combined with flashing, the system effectively drains water, based on testing in accordance with ASTM E2273.

   StoGuard® is not intended to correct faulty design or workmanship, such as the absence or improper integration of flashing, roofing, copings, and sealants in the construction, which shed water and prevent water entry into wall construction. StoGuard® is not intended to correct defective components of construction such as windows that leak into the wall assembly. Basic principles that should be followed in the design, detailing, and construction of the wall assembly include:

2. Flashing: provide flashing to direct water to the exterior where it is likely to penetrate components in the wall assembly, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, abutments of lower walls with higher walls, above projecting features, at floor lines, and at the base of the wall.

3. Air Leakage Prevention: provide continuity of the air barrier assembly at foundation, roof, windows, doors, and other penetrations through the wall with connecting and compatible air barrier components, to minimize condensation caused by air movement. In most cases StoGuard Detail Components will facilitate detailing at these transitions. Take into account construction sequencing when designing an airtight assembly and the effects of airtightness on mechanical ventilation in the overall project design.

4. Water Vapor Diffusion: perform a dew point analysis and/or dynamic hygrothermal modeling of the wall assembly to determine the potential for accumulation of moisture by diffusion of water vapor. Adjust insulation thickness and/or other wall assembly components accordingly to eliminate or minimize the risk of a dew point in the wall assembly. Avoid the use of vapor retarders on the interior side of the wall in hot, humid climates.

Continued on next page

Moisture Protection (cont'd)

5. Terminations and Sealants: Provide minimum 1/2 inch (13 mm) wide perimeter sealant joints at all penetrations through StoTherm®ci (windows, doors, scuppers, mechanical, electrical, and plumbing penetrations, etc.).

6. Size joints at terminations based on anticipated movement and specify sealant and backer rod that is compatible with StoTherm® ci, supported by the sealant manufacturer's certificate of compatibility. Typically, sealant is adhered to the StoTherm ci reinforced base coat or primed base coat.

   Arrange for field adhesion testing to verify adhesion compatibility and obtain the sealant manufacturer's adhesion data to the sealant substrate(s).

   Maintain air barrier continuity across joints. Drain joints to the exterior or provide other means to prevent or control water infiltration at joints.

7. Grade Condition: Provide minimum 6-inch (152mm) clearance above grade or as required by code. Do not specify StoTherm® ci for use below grade.

8. Testing: conduct mock-up testing of the opaque wall-to-window assembly and other critical construction details to verify performance – air leakage resistance (ASTM E283), resistance to wind-driven rain (ASTM E331), and wind load resistance (ASTM E330).

   Do not use StoTherm®ci on surfaces subject to continuous or intermittent water immersion or hydrostatic pressure. Prevent the accumulation of water behind StoTherm ci, either by condensation or water leakage into the wall construction, in the design and detailing of the wall assembly, and with proper sequencing and protective measures during construction.

   For further information see **Sto Tech Hotline No. 0403-BSc, Critical Detail Checklist for Wall Assemblies, Sto Tech Hotline No. 0603-BSc, Moisture Control Principles for Design and Construction of Wall Assemblies,** and **Sto Tech Hotline No. 1001-BSc, Effects of Temporary Heating on Construction Materials in Cold Weather.**

Impact Resistance

StoTherm®ci meets standard, medium, high, and ultra-high impact resistance ratings, depending on the type of mesh reinforcement used with the base coat, when tested in accordance with ASTM E2458. Ultra-high impact resistance, achieved by embedding Sto Armor Mat 15oz or 20oz reinforcing mesh in Sto base coat, is recommended at ground floors to a minimum height of 6 ft (1.8m) and at any other areas of abnormal stress or impact.

The addition of Sto Strike Defense, StoArmat Classic Plus with Sto Mesh embedded over the ultra-high impact resistant base coat assembly, provides a fortification layer that is resistant to impact from both blunt and sharp objects and woodpeckers. StoTherm®ci MVES with adhered thin brick, stone, or tile is another available option to provide a fortified impact resistant finished surface. Refer to Sto Details.

The StoTherm®ci system also meets FBC (Florida Building Code) and Miami-Dade County hurricane test protocols for large and small missile impact resistance (requires supplemental mesh reinforcement of the sheathing surface on frame walls with gypsum sheathing to achieve large missile impact resistance). Refer to Miami-Dade County, Florida NOAs (Notices of Acceptance).

Continued on next page

Acoustics

Acoustical controls are achieved primarily in the base wall assembly, for example, in frame wall construction through the use of batt insulation in the stud wall cavity, gypsum sheathing, and wood or metal stud configuration. Refer to the Gypsum Association Fire Resistance and Sound Control Design Manual for technical data on performance of base wall assemblies.

Aesthetics

A wide variety of aesthetic choices and colors exist with Sto textured finishes, available in smooth, fine, medium, and coarse textures that are applied by trowel or spray application. Sto Specialty finishes offer unique architectural surfaces through the use of colored aggregate blends that are applied by trowel or spray application. StoCast finishes are factory made veneer units that achieve the look of wood, stone, brick, and other architectural finishes in a range of sizes, styles, and colors, with simplified application methods.

Dark colored finishes [LRV (Light Reflectance Value) less than 20] are not recommended unless reviewed by the design professional with regard to service temperature limitations of the foam plastic insulation [(limited to a maximum service temperature of 165°F (74.8°C)], and anticipated temperatures on the façade surface through the life of the building.

Architectural features – trim, sills, ledges, build-outs, reveals: all trim and projecting architectural features must have a minimum 1:2 [27°] slope along their top surface. All reveals must have minimum ¾ inch (19 mm) insulation thickness at the bottom of the reveal. All horizontal reveals must have a minimum 1:2 [27°] slope along their bottom surface. Increase slope for northern climates to prevent accumulation of ice/snow and water on sloped surfaces. Where trim/feature or bottom surface of reveals project more than 2 inches (51 mm) from the face of the EIFS wall plane, protect the top surface with waterproof base coat. Periodic inspections and increased maintenance may be required to maintain surface integrity of the finish on weather exposed sloped surfaces. Limit projecting features to easily accessible areas and limit total area to facilitate and minimize maintenance. Refer to Sto Details.

Do not use StoTherm®ci on top of parapets or on large weather exposed projecting ledges, sills, or other projecting features unless supported by framing or other structural support and protected with metal coping or flashing.

Joints

Joints are required at:

· Joints in the supporting wall construction such as expansion joints, control joints, and cold joints

· Perimeters of windows, doors, scuppers, fixture attachments, and similar objects in the wall construction

· Changes in substrate or support construction (e.g., masonry to frame wall) or other junctures with dissimilar construction

· Floor lines in multi-story wood frame wall construction

· Floor line deflection joints

· Changes in building height and other areas of stress concentration

· Panel-to-panel joints in prefabricated panel wall construction

Do not bridge expansion joints, control joints, or cold joints in wall construction with StoTherm®ci.

Continued on next page

Regulatory Compliance

The StoTherm®ci System complies with the weather resistance requirements of the 2018 IBC Sections 1407.2 and 1407.4, and complies with requirements of Chapter 26 for use on noncombustible construction (Types I, II, II, and IV), and on fire-resistance rated wall assemblies. The system also complies with ASHRAE 90.1-2019 Section 5, Building Envelope, air barrier and continuous insulation requirements.

StoGuard complies with IBC, IRC, and IECC (International Energy Conservation Code) requirements as an air barrier material and water-resistive barrier. It meets requirements as an air barrier material based on testing in accordance with ASTM E2178 and as an air barrier assembly based on testing in accordance with ASTM E2357. Refer to ICC ESR-1233.

All Sto architectural coatings, textured and specialty finishes, primers, sealers, waterproofers, and underlayments comply with South Coast Air Quality Management District (South Coast AQMD) volatile organic compound (VOC) requirements.

Thermal Insulation

StoTherm®ci uses expanded polystyrene (EPS) insulation board as the thermal insulating component. The insulation board is applied adhesively to StoGuard on a supporting substrate to create a continuous exterior insulating thermal barrier. Thickness is limited based on structural considerations and fire testing. Minimum thickness is 1 inch (25mm). Maximum thickness is 12 inches (305mm) on noncombustible construction, and in some cases may be limited to six inches (152mm), depending on finish selection. Refer to ICC ESR-1748. If walls are required to have an hourly fire-resistance rating, maximum thickness is 4 inches.

Sto EPS Insulation conforms with ASTM E2430 and ASTM C578 Type I requirements. R-value is R-3.6 F•ft^2•h/Btu per inch thickness at 75°F (RSI-0.634 K•m^2/W per 25mm at 24°C).

Insulation material is flammable and must be kept away from flame, ignition sources, high heat and temperatures in excess of 165°F [74.8° C]).

Sustainability

StoTherm®ci has high potential for LEED and other sustainability program credits based on efficient and effective use of a continuous air barrier, continuous exterior insulation, and the resulting energy savings and reductions in greenhouse gas emissions. The system also has positive impacts on life cycle energy use based on reduced dead load, which permits the use of lighter gage metal studs, and supporting structural members and foundation footings, when compared to other wall systems such as full thickness/weight masonry veneer walls. The use of light gage metal framing with recycled content and StoPanel prefabricated wall construction offers additional means to obtain credits. Refer to StoPanel Technology information and ICC ESR-4500.

Accessories

Accessories for use with StoTherm®ci are:

1. StoSeal STPE Sealant, a high-movement, low modulus, non-sag one-component silyl-terminated polyether joint sealant in compliance with ASTM C920 and tested in accordance with ASTM C1382.
2. Sto-Mesh Corner Bead Standard, a one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh for outside corner reinforcement.
3. Sto Drip Edge Profile, a one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh that creates a drip edge and plaster return.

Table 1.1 - StoGuard® Product Application

StoGuard® Detail Component	Sheathing Joints and Corners	Flashing and Rough Opening Protection	Penetrations	Static Joints and Seams	Dynamic Joints
Sto RapidGuard®	✓	✓	✓	✓	
StoGuard® Conformable Membrane	✓	✓	✓	✓	✓
StoGuard® Fluid Applied Air & Water-Resistive Barrier with StoGuard® Fabric	✓	✓	✓		
StoGuard® Transition Membrane embedded with any StoGuard® Fluid Applied Air & Water-Resistive Barrier				✓	✓
Sto Gold Fill with StoGuard® Mesh (or Sto Detail Mesh embedded)	✓	✓	✓		
Sto Gold Coat® TA with StoGuard® Mesh	✓	✓	✓		

[1] StoGuard® Fluid Applied Air & Water-Resistive Barriers: Sto AirSeal®, Sto Gold Coat®, Sto Gold Coat®TA, StoGuard®VaporSeal®

Additional Information

Refer to Sto product bulletins, guide specifications and guide details, technical hotlines, ICC Evaluation Reports, and other sources of information available at www.stocorp.com for more details on specific Sto products, features, benefits, and limitations that apply to StoTherm ci wall systems and components.

References:

1. American Society of Testing and Materials International (ASTM), Standard Specification for Rigid Cellular Polystyrene Thermal Insulation, ASTM C578.

2. American Society of Testing and Materials International (ASTM), Standard Test Methods for Fire Tests of Building Construction and Materials, ASTM E119.

3. American Society of Testing and Materials International (ASTM), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen, ASTM E283.

4. American Society of Testing and Materials International (ASTM), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference, ASTM E330.

5. American Society of Testing and Materials International (ASTM), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference, ASTM E331.

6. American Society of Testing and Materials International (ASTM), Standard Test Method for Determining Rate of Air Leakage Rate and Calculation of Air Permeance of Building Materials, ASTM E2178.

7. American Society of Testing and Materials International (ASTM), Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish System (EIFS) Clad Wall Assemblies, ASTM E2273.

8. American Society of Testing and Materials International (ASTM), Standard Specification for Expanded Polystyrene ("EPS") Thermal Insulation Boards for Use in Exterior Insulation and Finish Systems ("EIFS"), ASTM E2430.

9. American Society of Testing and Materials International (ASTM), Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies, ASTM E2357.

10. American Society of Refrigeration and Air Conditioning Engineers (ASHRAE), Energy Efficiency Standard for Buildings Except Low-Rise Residential Buildings, ANSI/ASHRAE/IES Standard 90.1-2019.

11. Gypsum Association, Fire Resistance and Sound Control Design Manual, GA-600-2021.

11. Gypsum Association, Fire Resistance and Sound Control Design Manual, GA-600-2021.

12. International Code Council Evaluation Service, Sto Rainscreen and Sto Rainscreen II Class PB Exterior Insulation and Finish Systems with Drainage, ICC ESR-1030.

13. International Code Council Evaluation Service, StoGuard with Sto Gold Coat, StoGuard with Sto EmeraldCoat, and StoGuard VaporSeal Air Barriers and Water-resistive Barriers, and StoEnergy Guard (StoGuard with Continuous Insulation), ICC ESR-1233.

14. International Code Council Evaluation Service, StoTherm ci, StoTherm ci, and StoTherm ci with StoCast Finishes, ICC ESR-1748.

15. International Code Council Evaluation Service, StoPanel Classic ci, StoPanel Impact ci, StoPanel XPS, StoPanel Classic NExT ci, and StoPanel Backup, ICC ESR-4500.

16. International Code Council, Inc., 2018 International Building Code (IBC).

17. International Code Council, Inc., 2018 International Energy Conservation Code (IECC).

18. International Code Council, Inc., 2018 International Residential Code (IRC).

19. National Fire Protection Association (NFPA), Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source, NFPA 268.

20. National Fire Protection Association (NFPA), Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components, NFPA 285.

21. Sto Corp., Critical Detail Checklist for Wall Assemblies, TH-0403-BSc.

22. Sto Corp., Moisture Control Principles for Design and Construction of Wall Assemblies, TH-0603-BSc.

23. Sto Corp. Effects of Temporary Heating on Construction Materials in Cold Weather, TH-1001-BSc.

Design Details

Components

System Components 52s.00
System Components with StoCast Brick ..... 52s.00 SCB
System Components with StoCast Wood ..... 52s.00 SCW
System Components with Ultra-High Impact Resistance 52s.01
System Components with Sto Strike Defense 52s.02

Installation at Grade

Termination at Grade: Sheathing Flush with Foundation or Slab Edge 52s.03A
Termination at Grade: Sheathing Overlapping Slab or Foundation 52s.03B

Installation of Aesthetic Feature

Aesthetic Feature Band 52s.04
Aesthetic Reveal 52s.05

Installation at Windows

Receptor-Type Window Sill: Rough Opening Protection 52s.23 A1
Receptor-Type Window Sill: Receptor with End Dam 52s.23 A2
Receptor-Type Window Sill: Window and Sill Flashing, Cladding, and Perimeter Weather and Air Seals..... 52s.23 A3
Receptor-Type Window Head: Rough Opening Protection/Flashing 52s.23 B1
Receptor-Type Window Head: Receptor and Window 52s.23 B2
Receptor-Type Window Head: Cladding, and Perimeter Weather and Air Seals..... 52s.23 B3
Flanged Window Sill: Rough Opening Protection/Flashing 52s.24 A1
Flanged Window Sill: Window and Trim 52s.24 A2
Flanged Window Sill: Cladding, and Perimeter Weather and Air Seals..... 52s.24 A3
Flanged Window Head: Rough Opening Protection/Flashing 52s.24 B1
Flanged Window Head: Window and Trim 52s.24 B2
Flanged Window Head: Cladding, and Perimeter Weather and Air Seals..... 52s.24 B3

Installation at Soffit

Soffit: Insulated and Unvented 52s.30
Soffit: Uninsulated and Vented 52s.31
Soffit: Uninsulated and Vented with StoCast Wood ..... 52s.31 SCW

Installation at Joints

Floor Line Without Deflection 52s.40
Floor Line With Deflection - Concealed Flashing and Drainage at Floor Line 52s.41A
Floor Line With Deflection - No Drainage at Floor Line 52s.41B

Installation at Balcony/Abutments

Balcony Floor/Wall 52s.42A
Balcony Ceiling/Wall 52s.42B

Installation at Dissimilar Cladding

Horizontal Termination at Dissimilar Cladding 52s.50
Vertical Termination at Dissimilar Cladding 52s.51A
Vertical Termination at Dissimilar Backup Wall Construction..... 52s.51B

(Continued on Page 3)

Design Details (cont'd)

Installation at Joints

Vertical Expansion Joint in Back-Up Wall 52s.52A
Vertical Expansion Joint in Back-Up Wall, StoTherm® ci and Dissimilar Cladding 52s.52B

Installation at Corners

Inside Corner with Dissimilar Backup Wall 52s.53
Inside and Outside Corner with Common Substrate and StoMesh Corner Bead Reinforcement 52s.54A
Inside and Outside Corner with Common Substrate and StoMesh Reinforcement 52s.54B

Installation at Parapets, Gravel Stop, Roofline

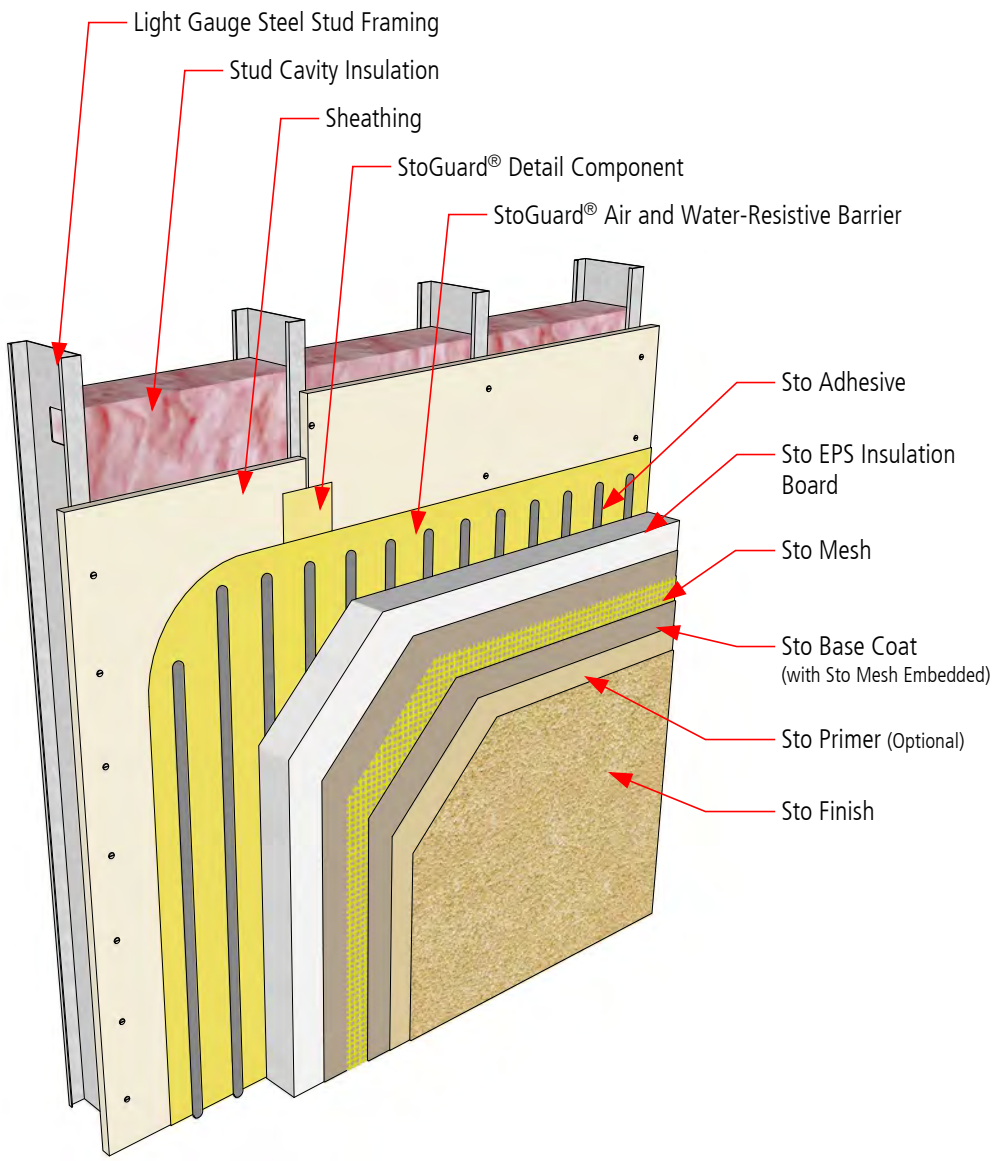
Termination at Parapet - Front 52s.60A
Termination at Parapet - Back 52s.60B
Parapet at Cornice Feature 52s.61
Diverter Flashing at Roof/Wall Abutment 52s.62
Gravel Stop 52s.63
Saddle Flashing at Lower/Higher Wall Abutment: Air & Water-Resistive Barrier 52s.64-1
Saddle Flashing at Lower/Higher Wall Abutment: Flashing 52s.64-2
Saddle Flashing at Lower/Higher Wall Abutment: Cladding, Coping and Sealant 52s.64-3

Installation at Penetrations

Scupper Penetration 52s.65
Pipe Penetration - Precision Cut Sheathing 52s.70A
Pipe Penetration - Rough Cut Sheathing 52s.70B
Sign Attachment 52s.71
Fixture Attachment 52s.73

StoTherm® ci
System Components with Sto Textured Finish

Detail No.: 52s.00
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

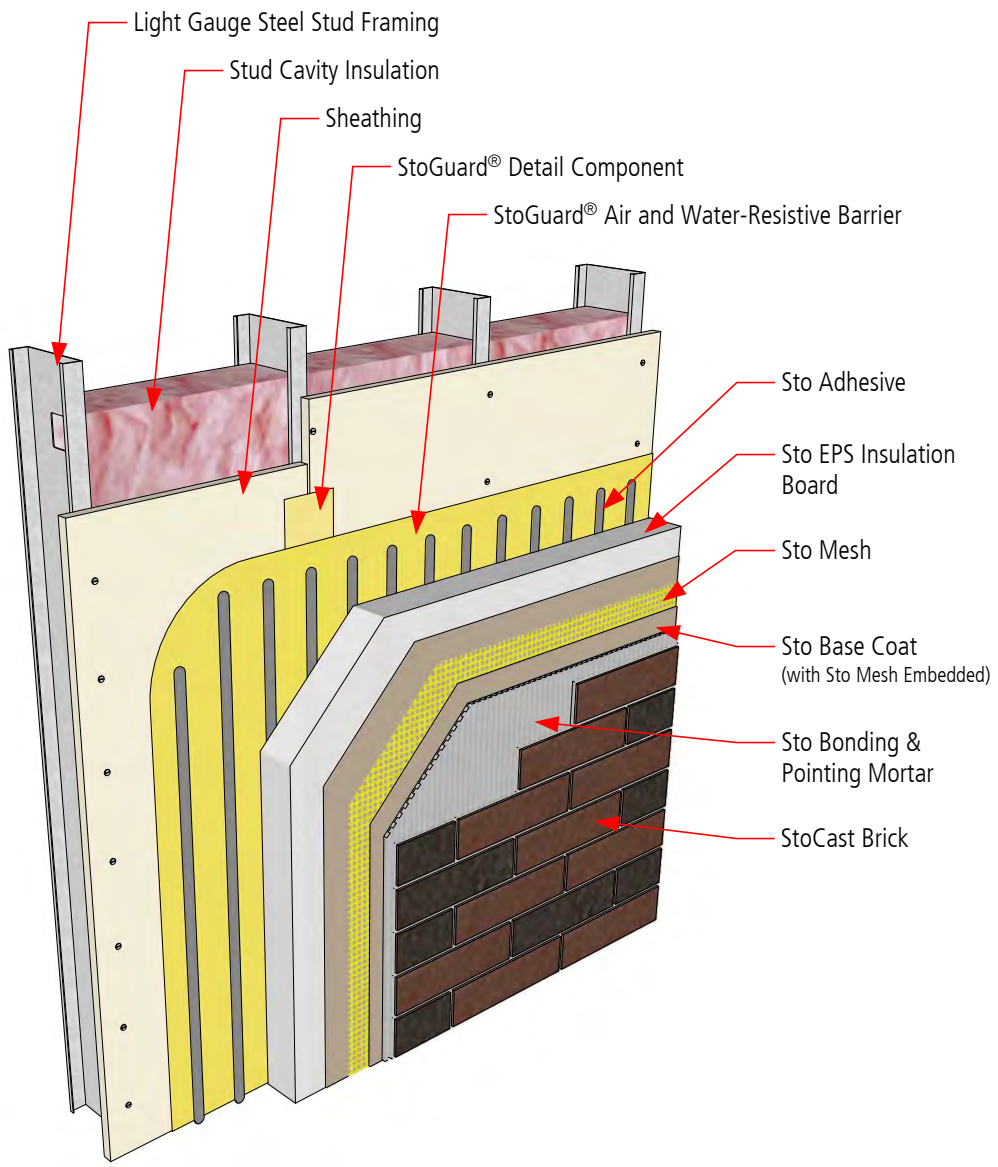
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
System Components with StoCast Brick

Detail No.: 52s.00 SCB
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

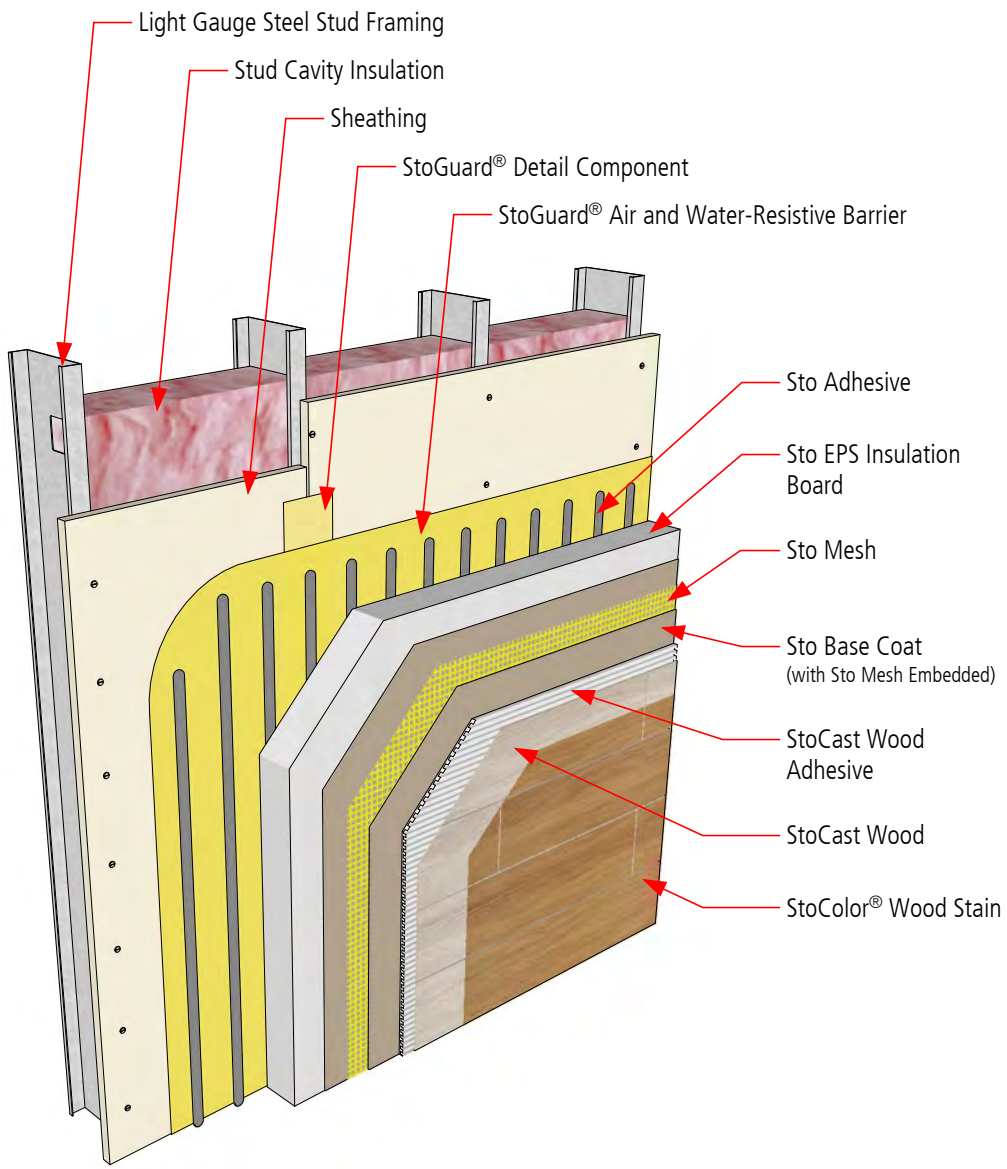
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
System Components with StoCast Wood

Detail No.: 52s.00 SCW
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

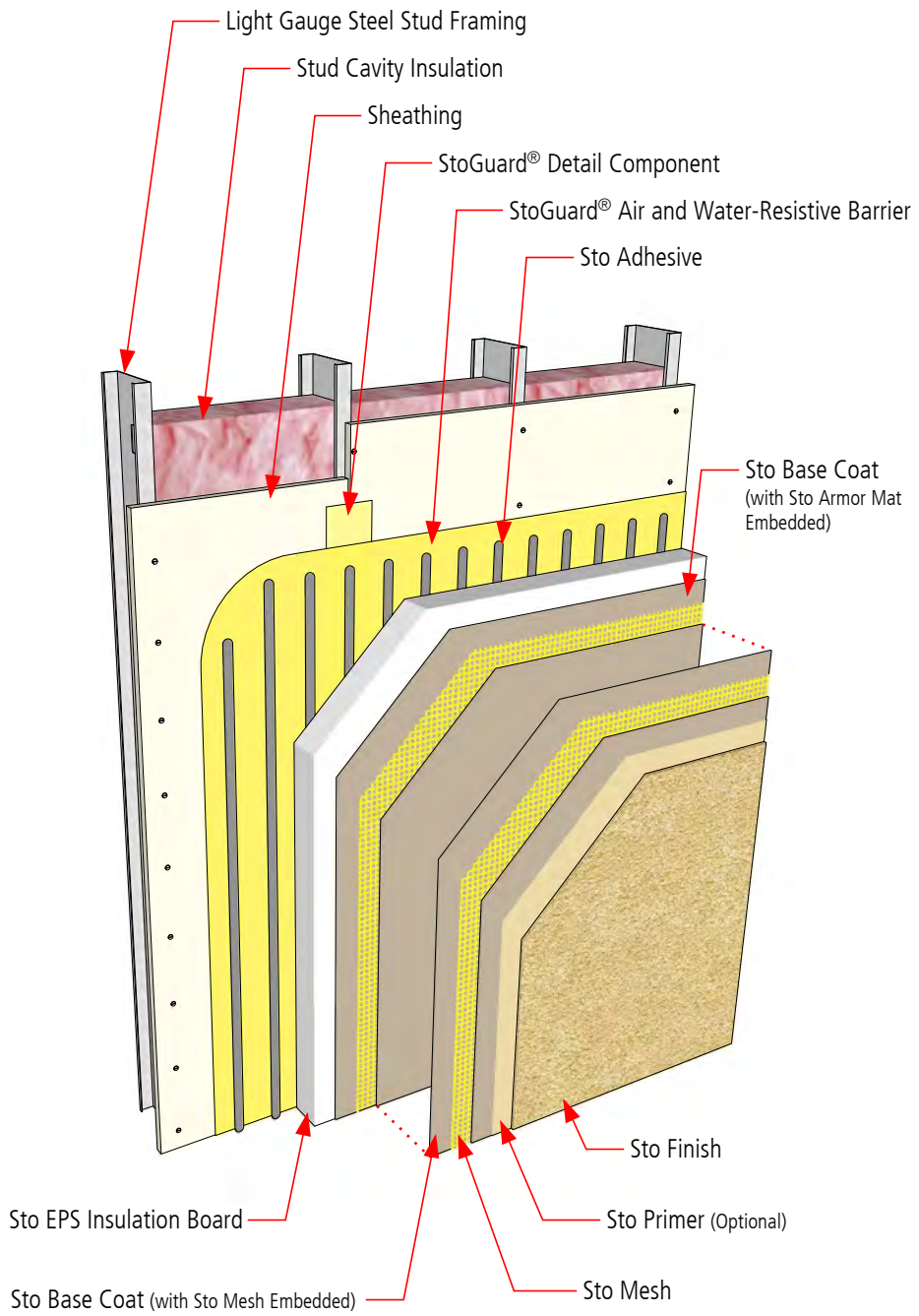
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
System Components: Ultra-High Impact Resistance

Detail No.: 52s.01
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

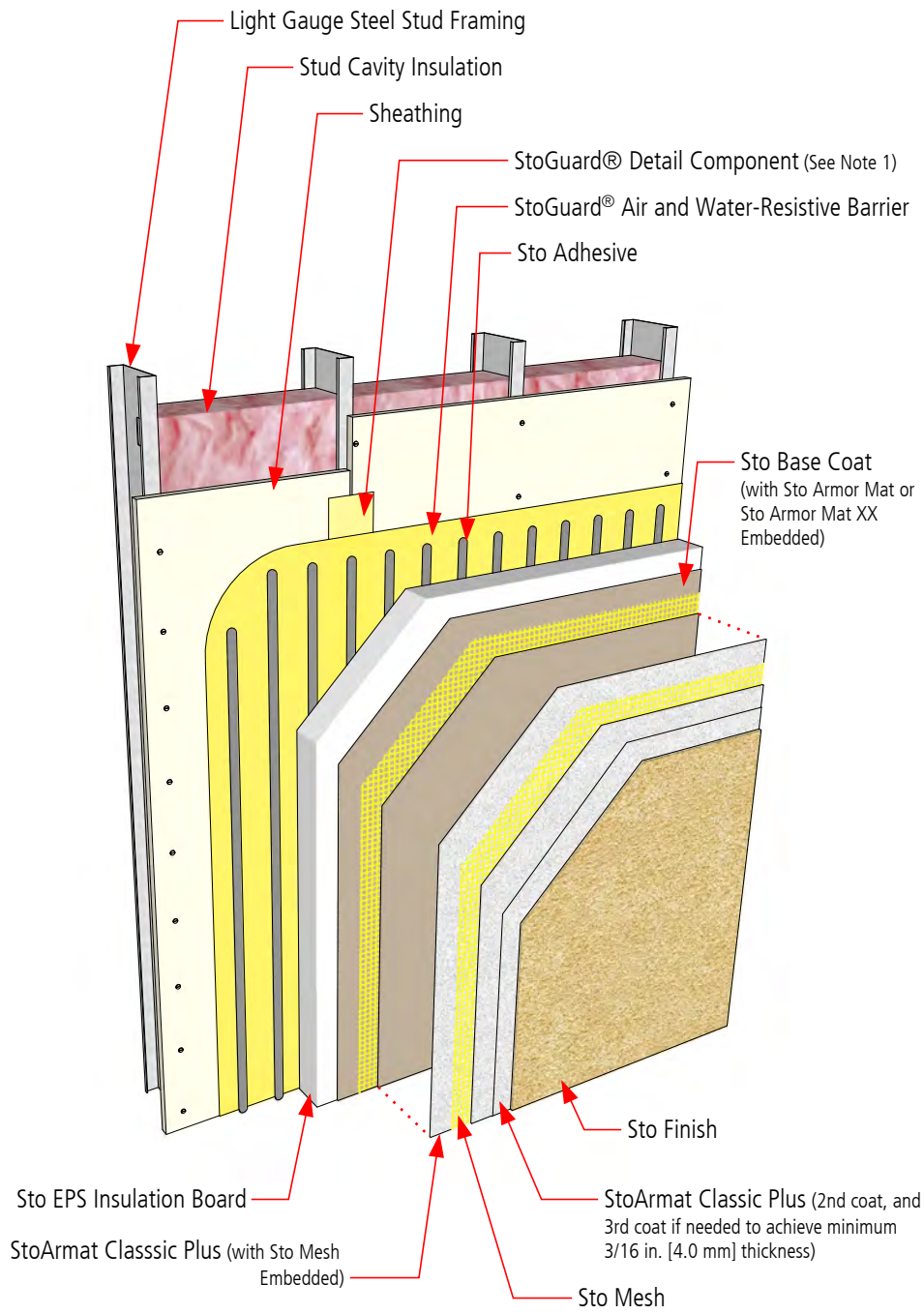
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
System Components: Sto Strike Defense

Detail No.: 52s.02
Date: April 2024



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved.

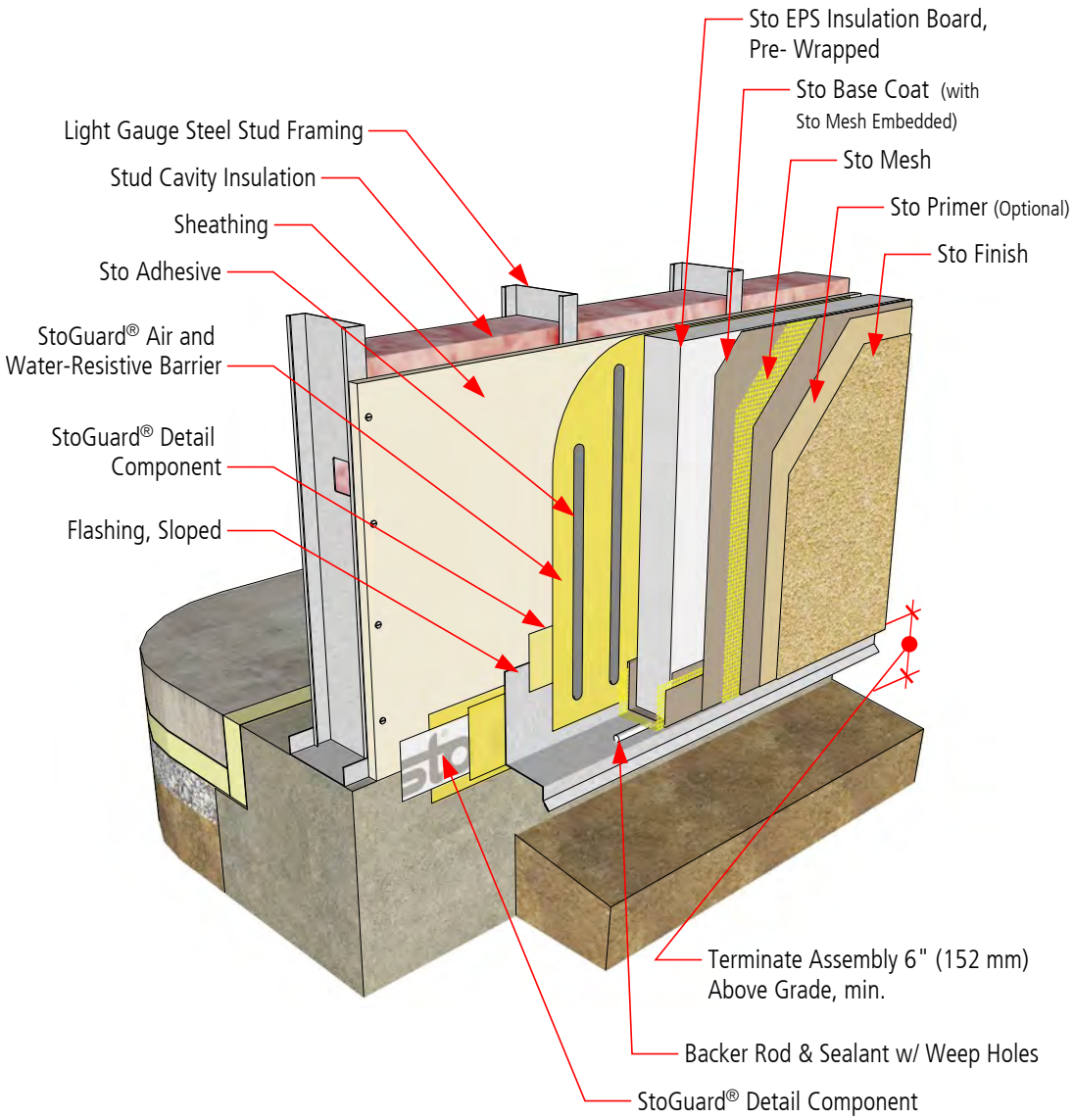
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Termination at Grade - Sheathing Flush with Foundation or Slab Edge

Detail No.: 52s.03A
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

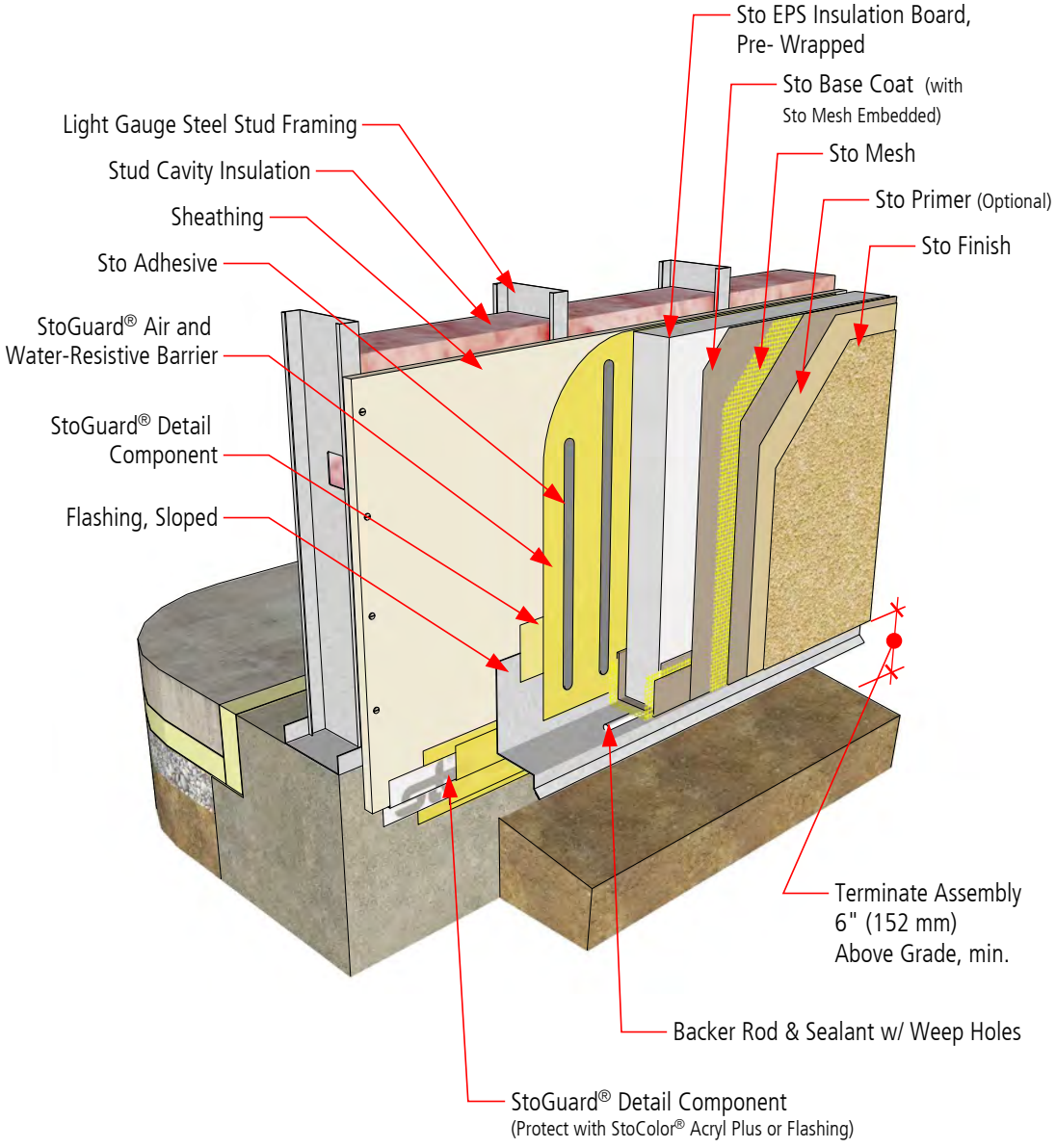
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Termination at Grade - Sheathing Overlapping Slab or Foundation

Detail No.: 52s.03B
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

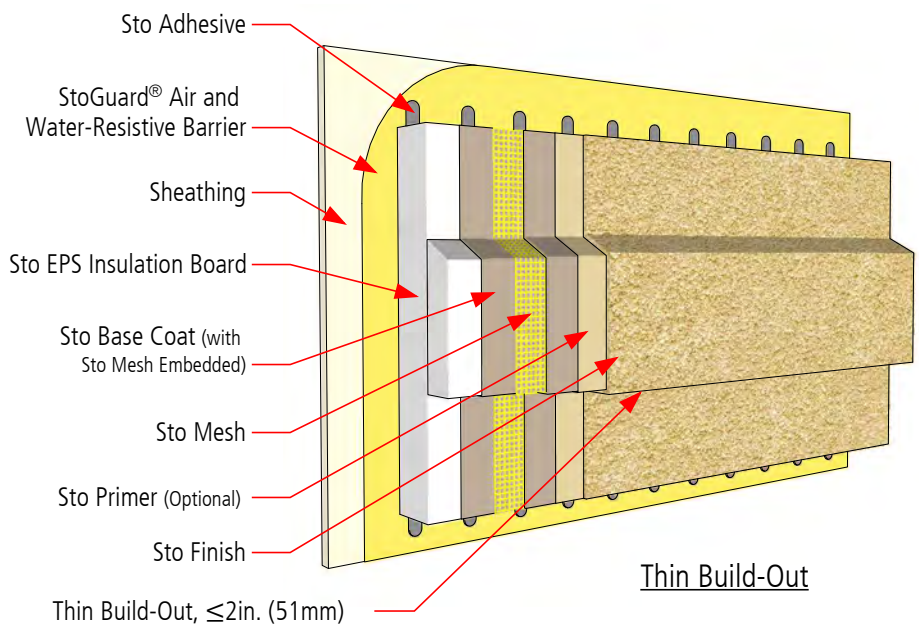
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

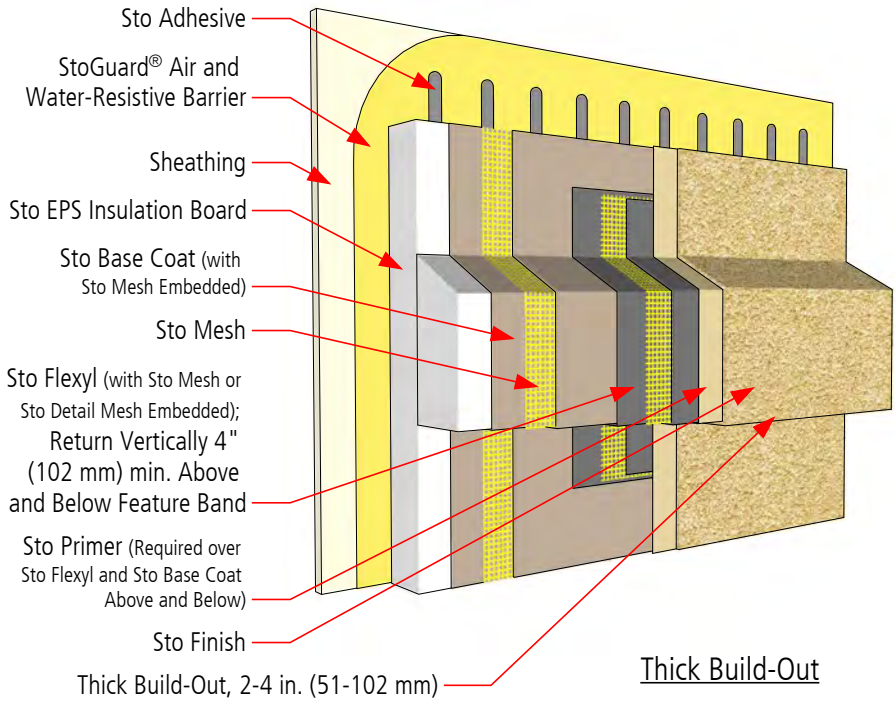
STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Aesthetic Feature Band

Detail No.: 52s.04
Date: June 2022



Thin Build-Out



Thick Build-Out

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

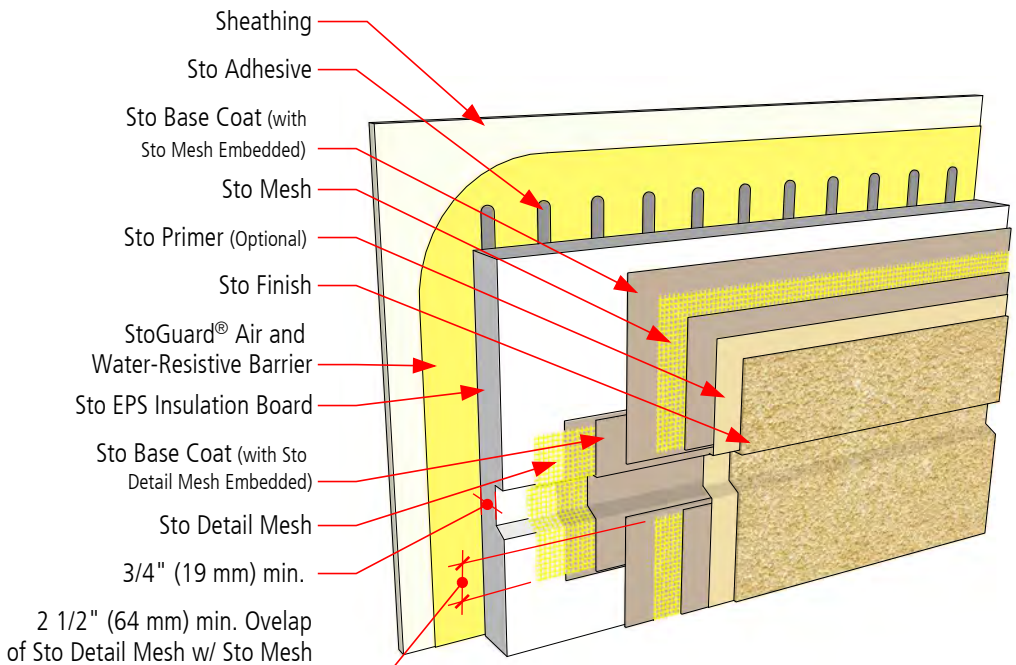
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

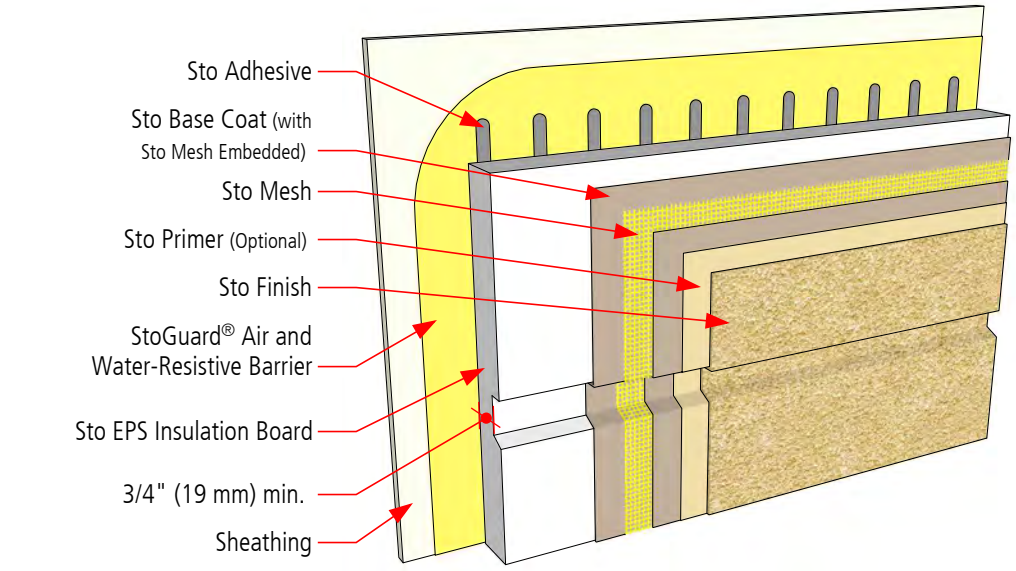
STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Aesthetic Reveal

Detail No.: 52s.05
Date: June 2022



Option 1 with Sto Detail Mesh



Option 2 with Continuous Sto Mesh

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

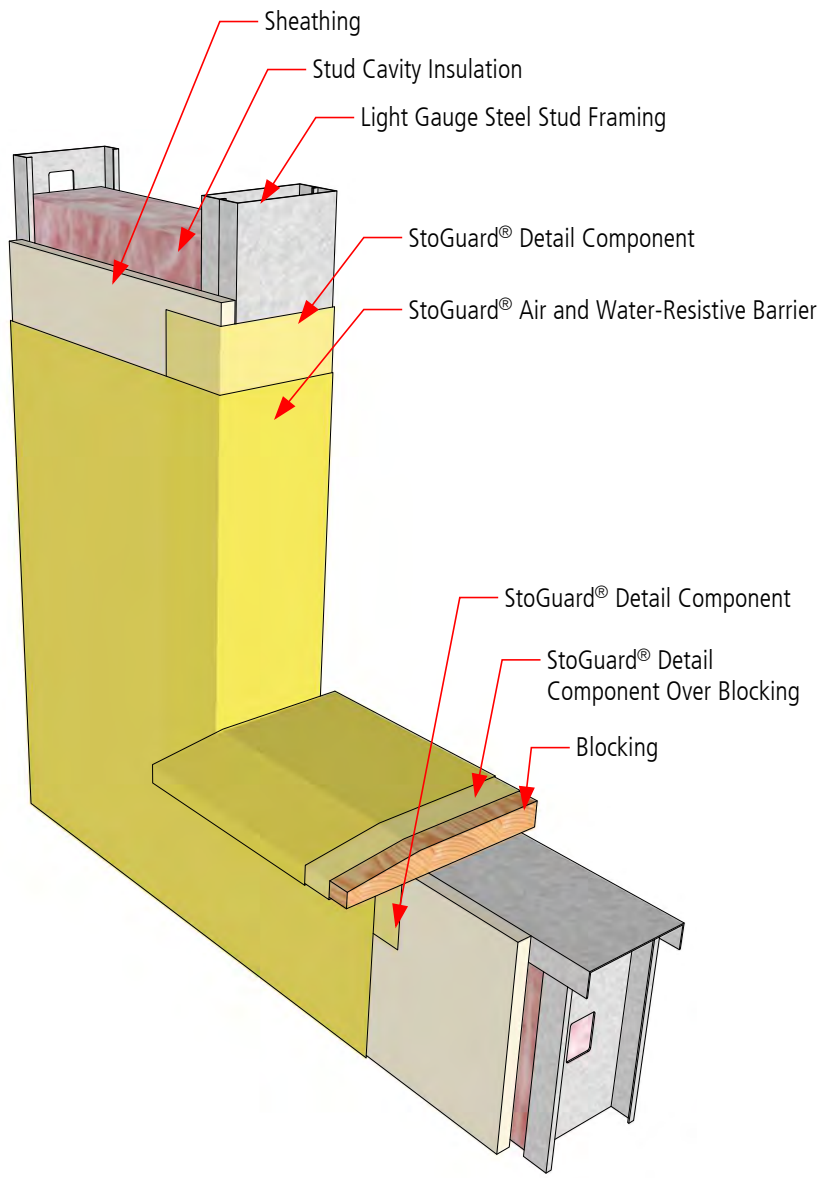
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Receptor-Type Window Sill

Detail No.: 52s.23A-1
Date: June 2022



Step 1 - Rough Opening Protection

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

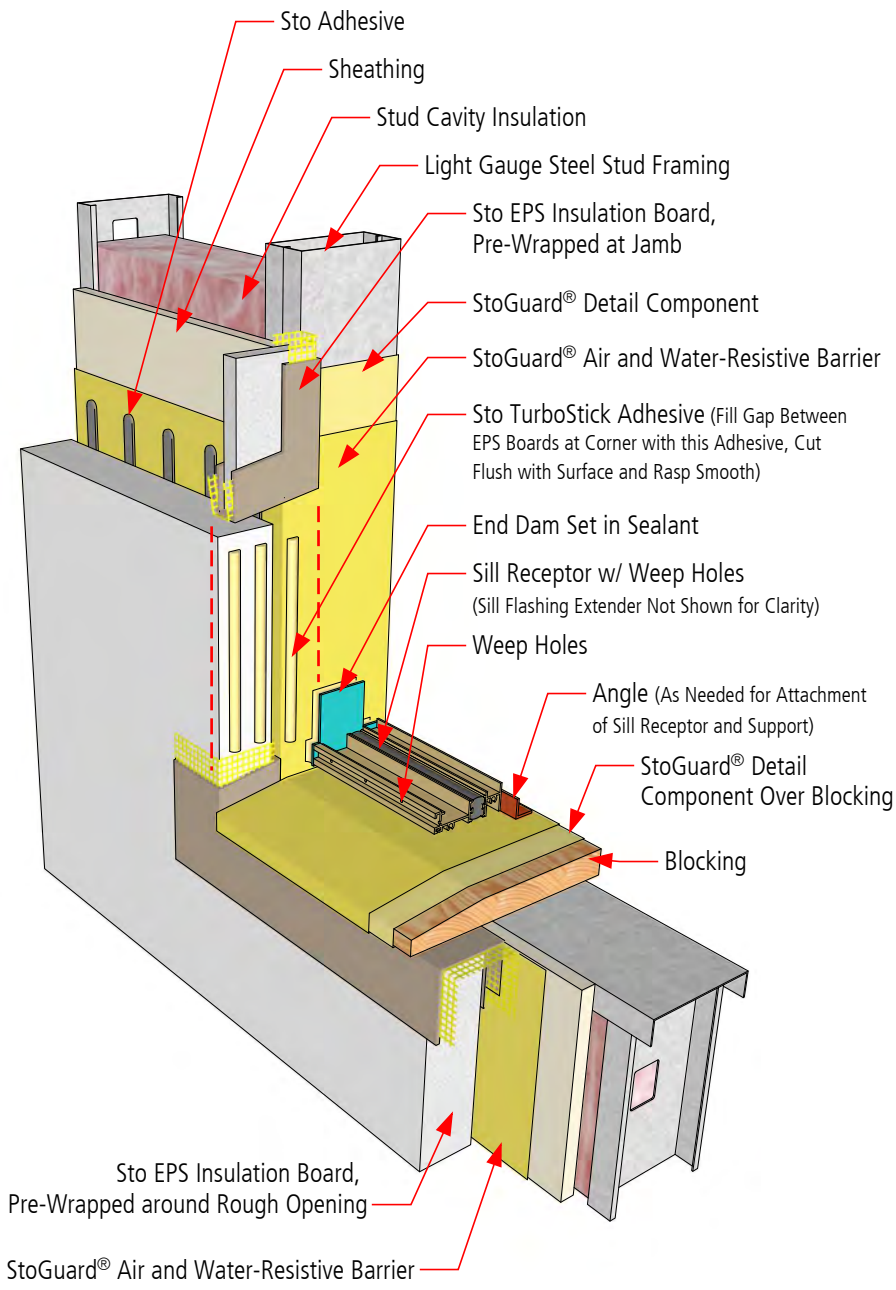
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Receptor-Type Window Sill

Detail No.: 52s.23A-2
Date: June 2022



Step 2 - Receptor with End Dam

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

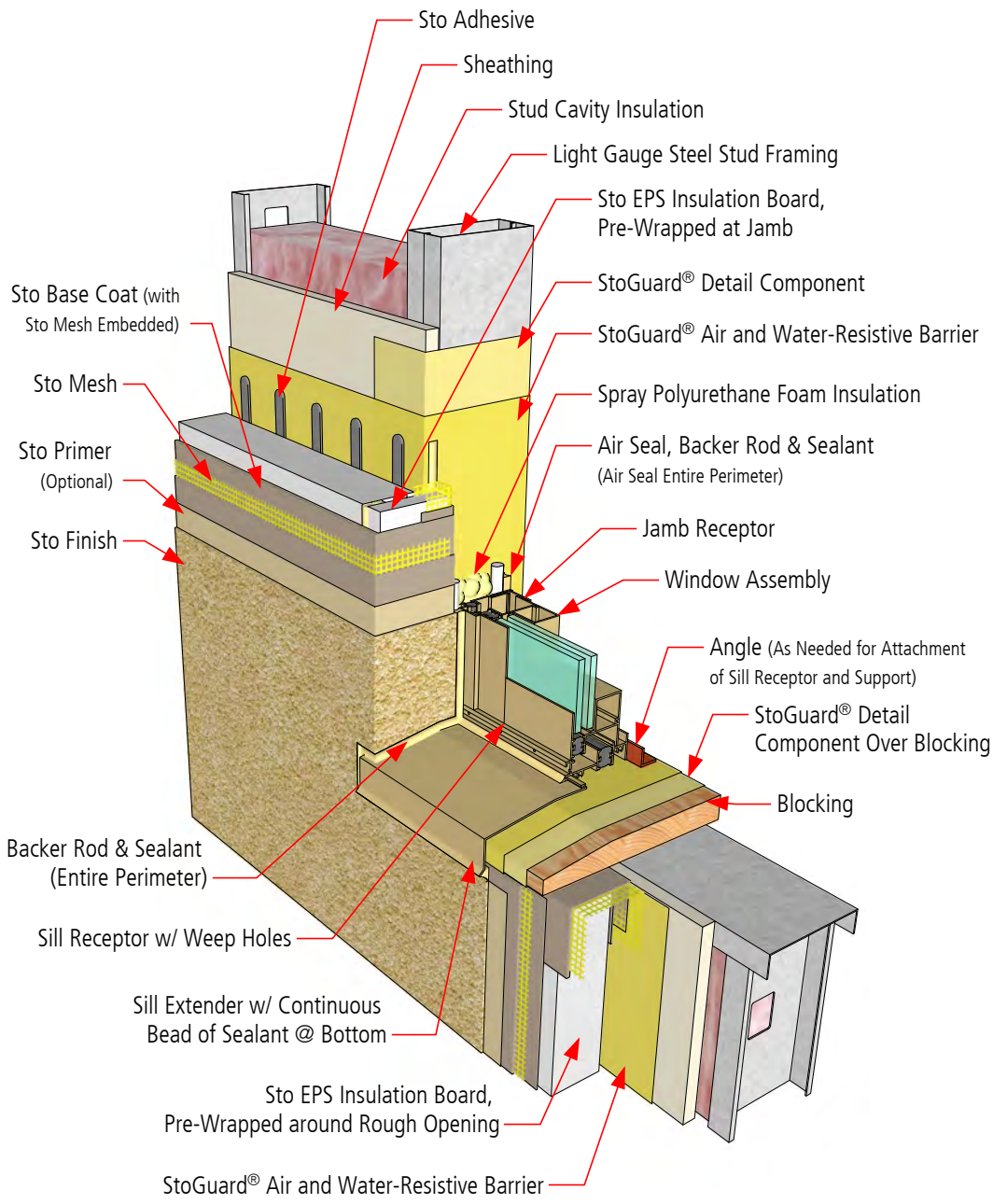
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Receptor-Type Window Sill

Detail No.: 52s.23A-3
Date: June 2022



Step 3 - Window and Sill Flashing, Cladding, and Perimeter Weather and Air Seals

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

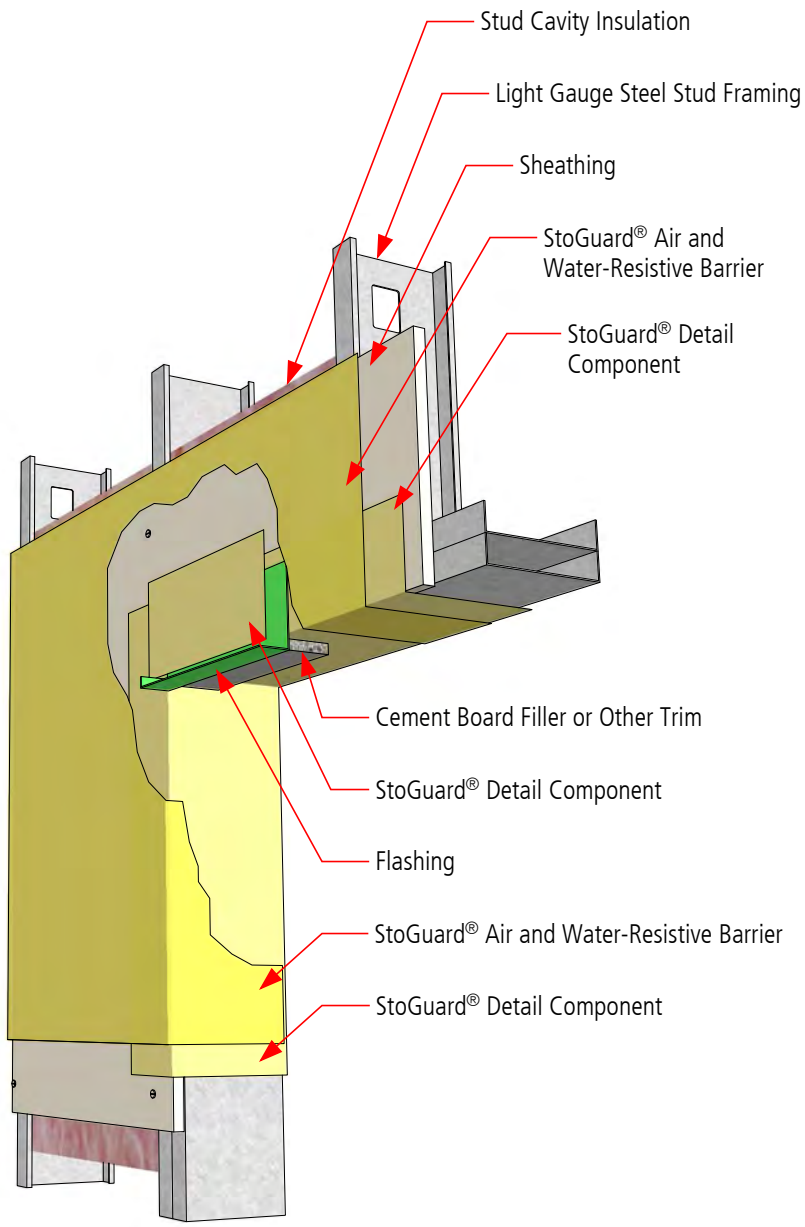
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Receptor-Type Window Head

Detail No.: 52s.23B-1
Date: June 2022



Step 1 - Rough Opening Protection, Head Flashing

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

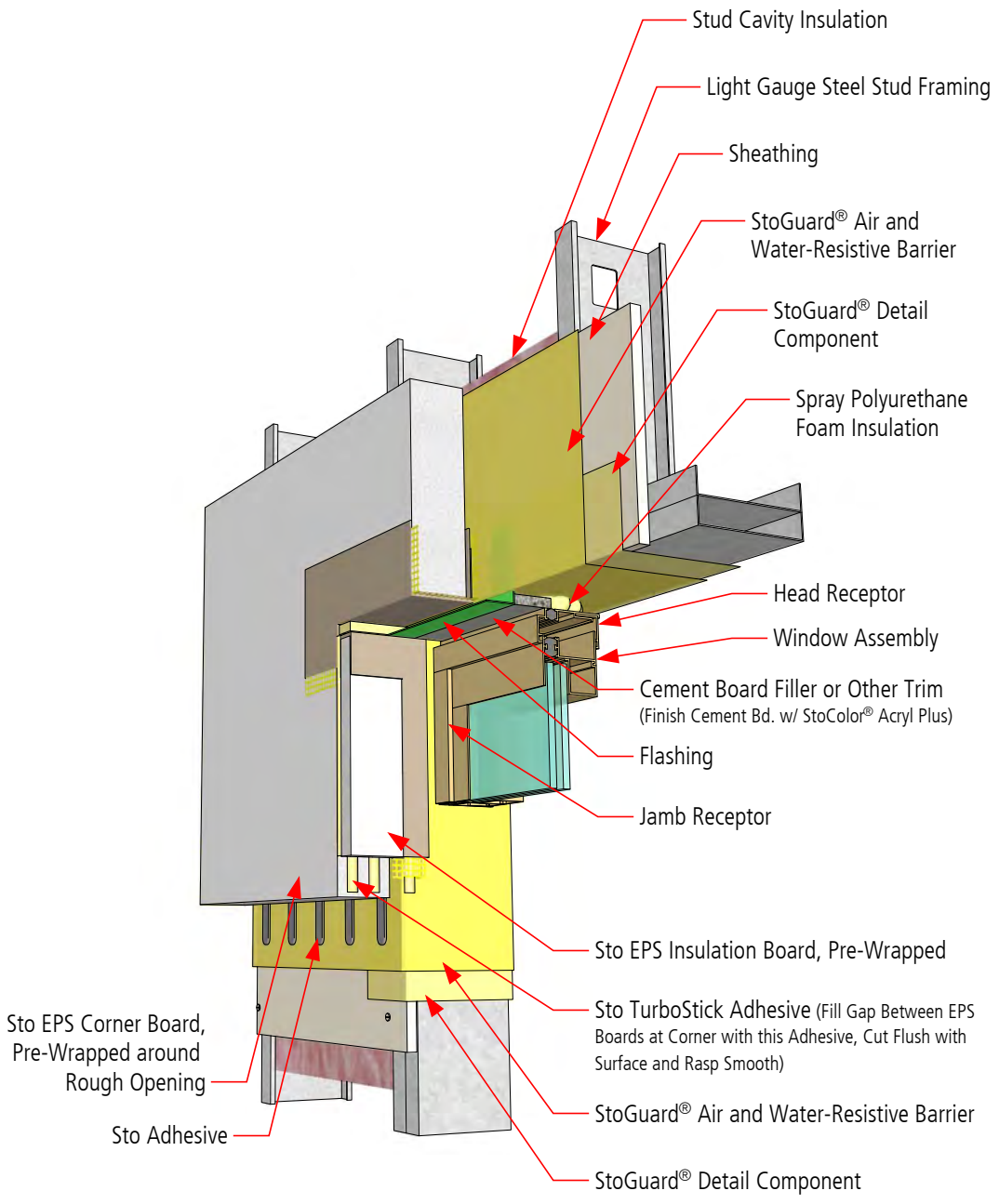
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Receptor-Type Window Head

Detail No.: 52s.23B-2
Date: June 2022



Step 2 - Receptor and Window

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

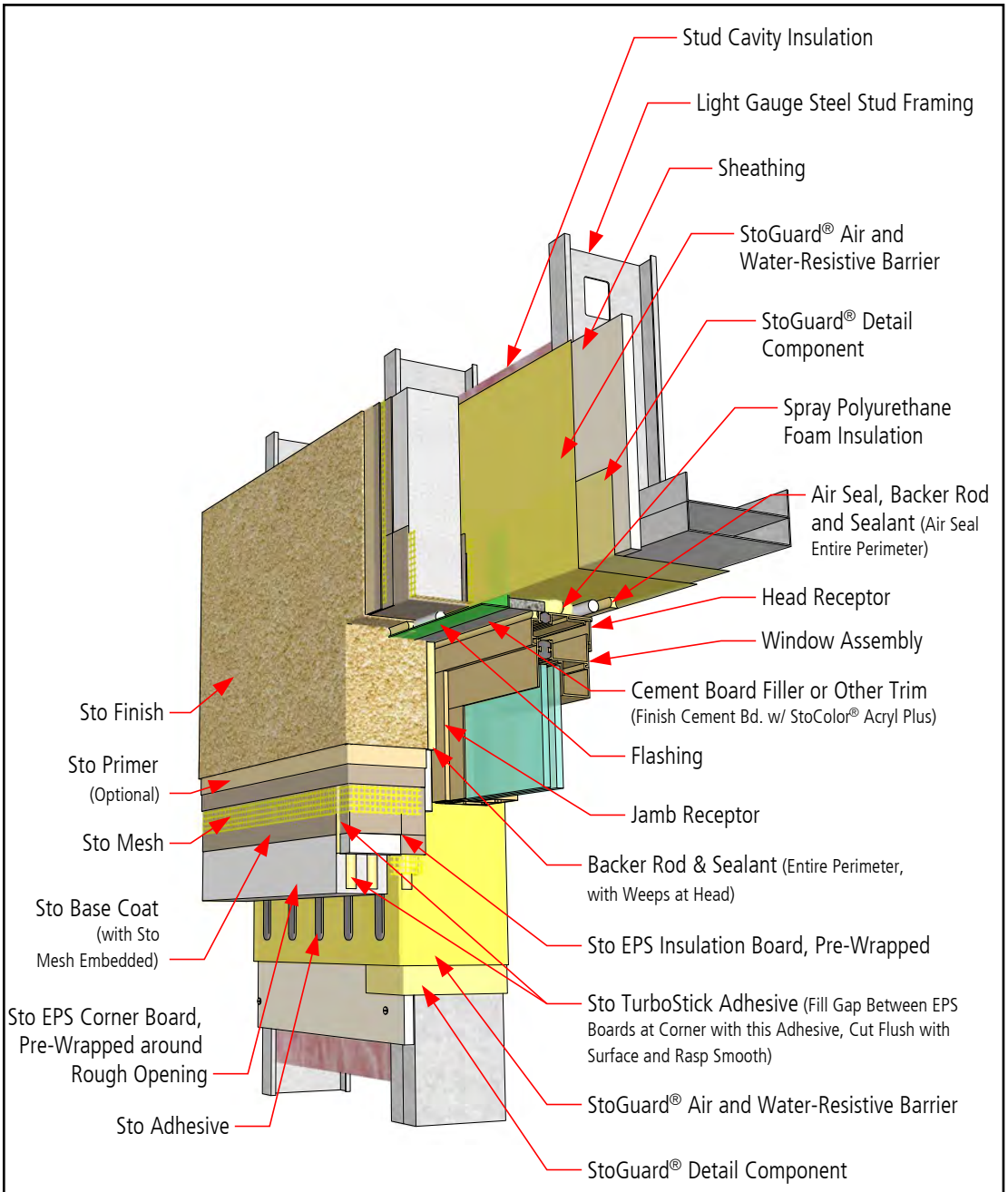
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Receptor-Type Window Head

Detail No.: 52s.23B-3
Date: June 2022



Step 3 - Cladding and Perimeter Weather and Air Seals

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

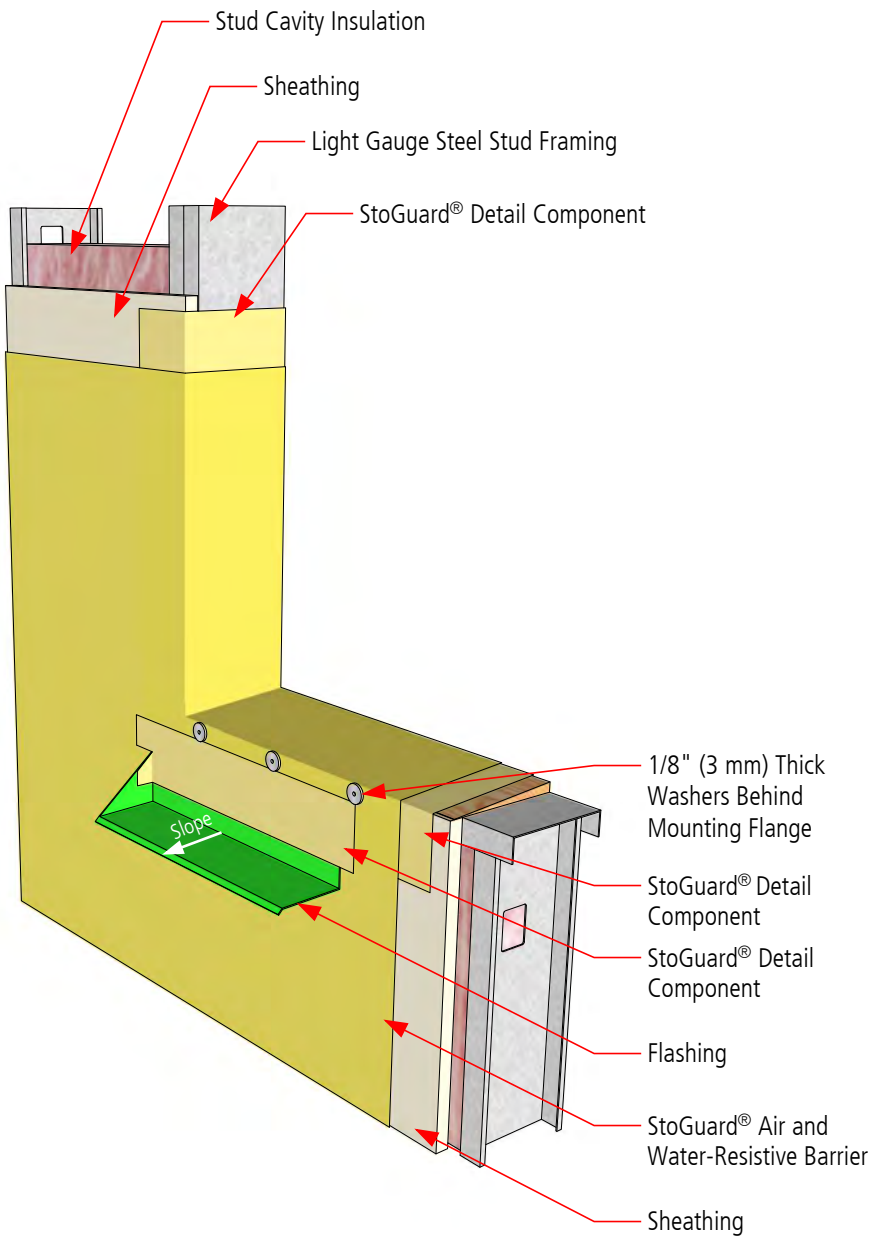
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Flanged Window-Sill

Detail No.: 52s.24A-1
Date: June 2022



Step 1 - Rough Opening Protection, Sill Flashing

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

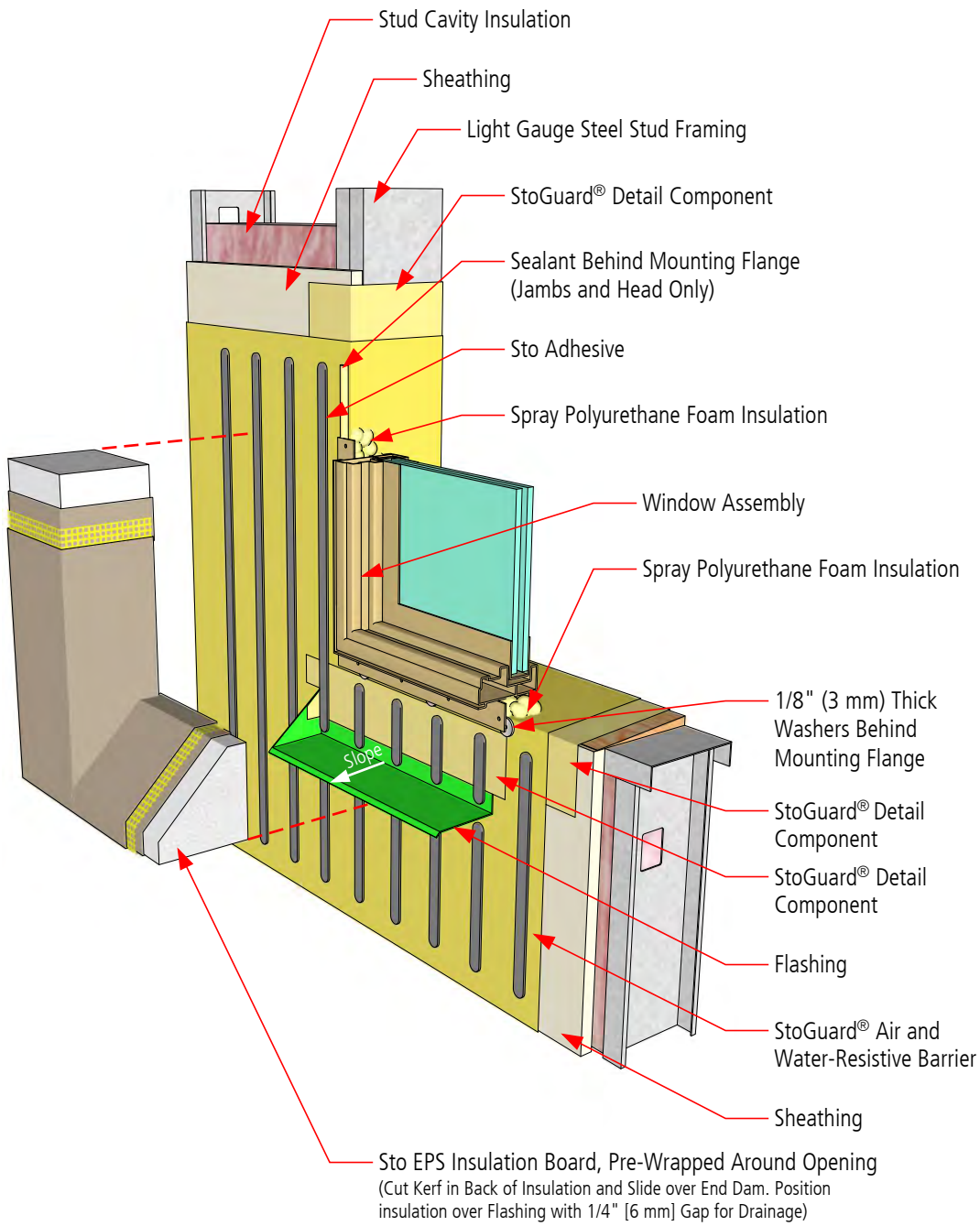
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Flanged Window-Sill

Detail No.: 52s.24A-2
Date: June 2022



Step 2 - Window and Trim

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

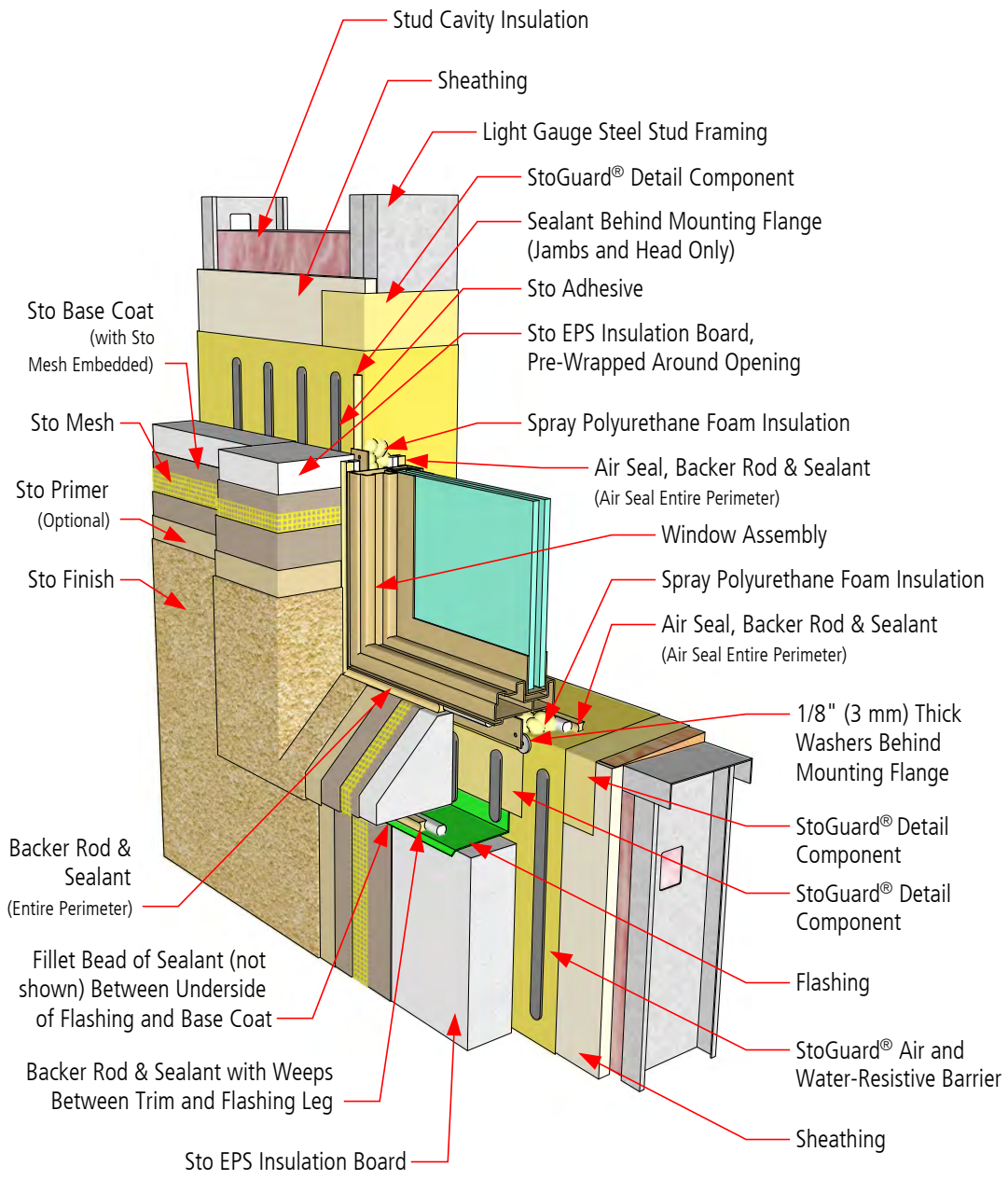
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Flanged Window-Sill

Detail No.: 52s.24A-3
Date: June 2022



Step 3 - Cladding and Perimeter Weather and Air Seals

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

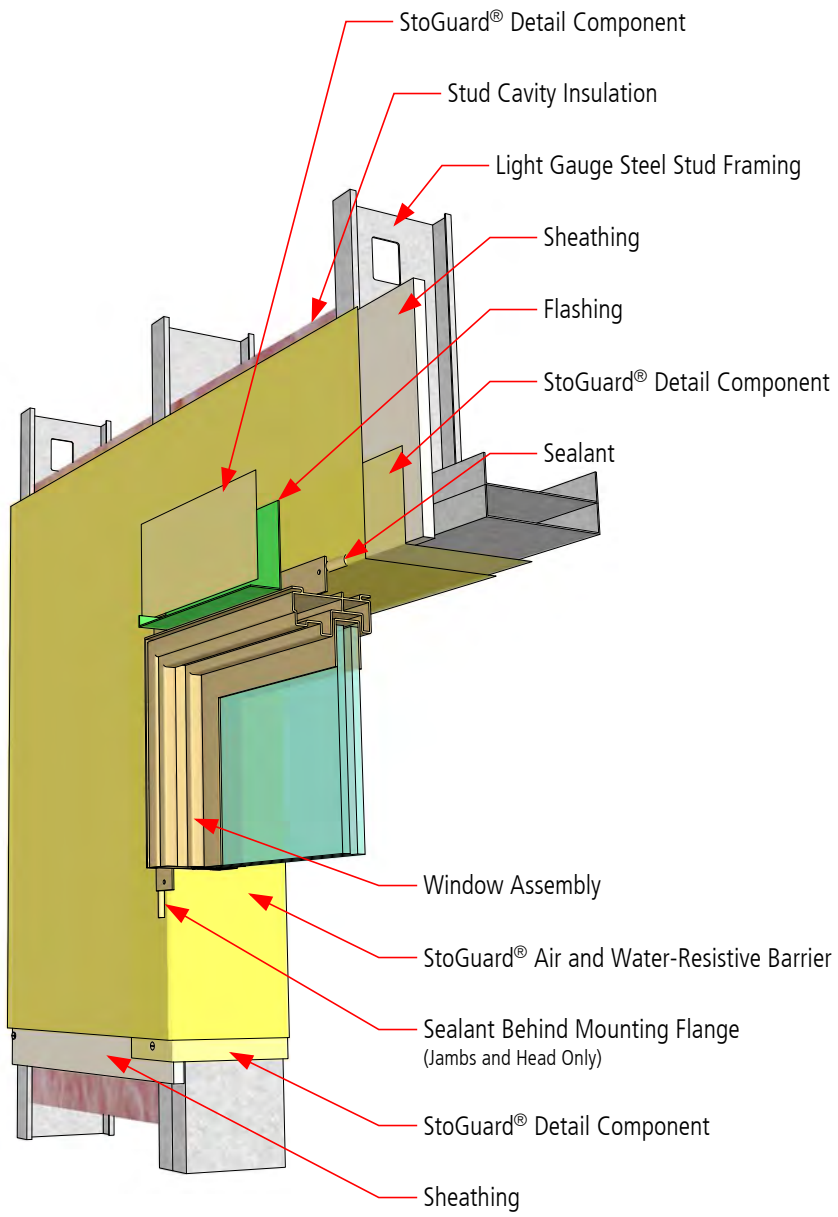
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Flanged Window-Head

Detail No.: 52s.24B-1
Date: June 2022



Step 1 - Rough Opening Protection, Head Flashing

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

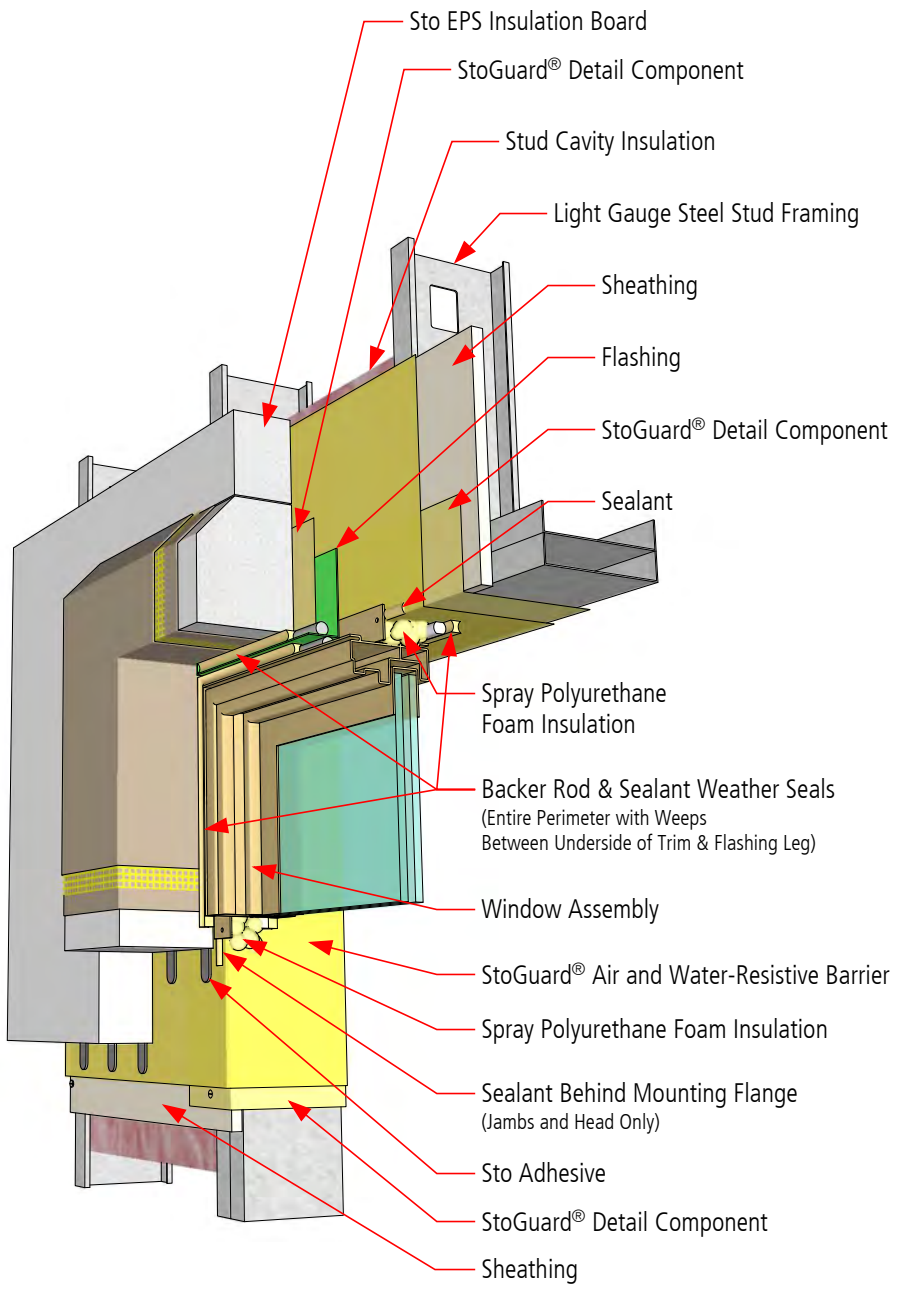
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Flanged Window-Head

Detail No.: 52s.24B-2
Date: June 2022



Step 2 - Window and Trim

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

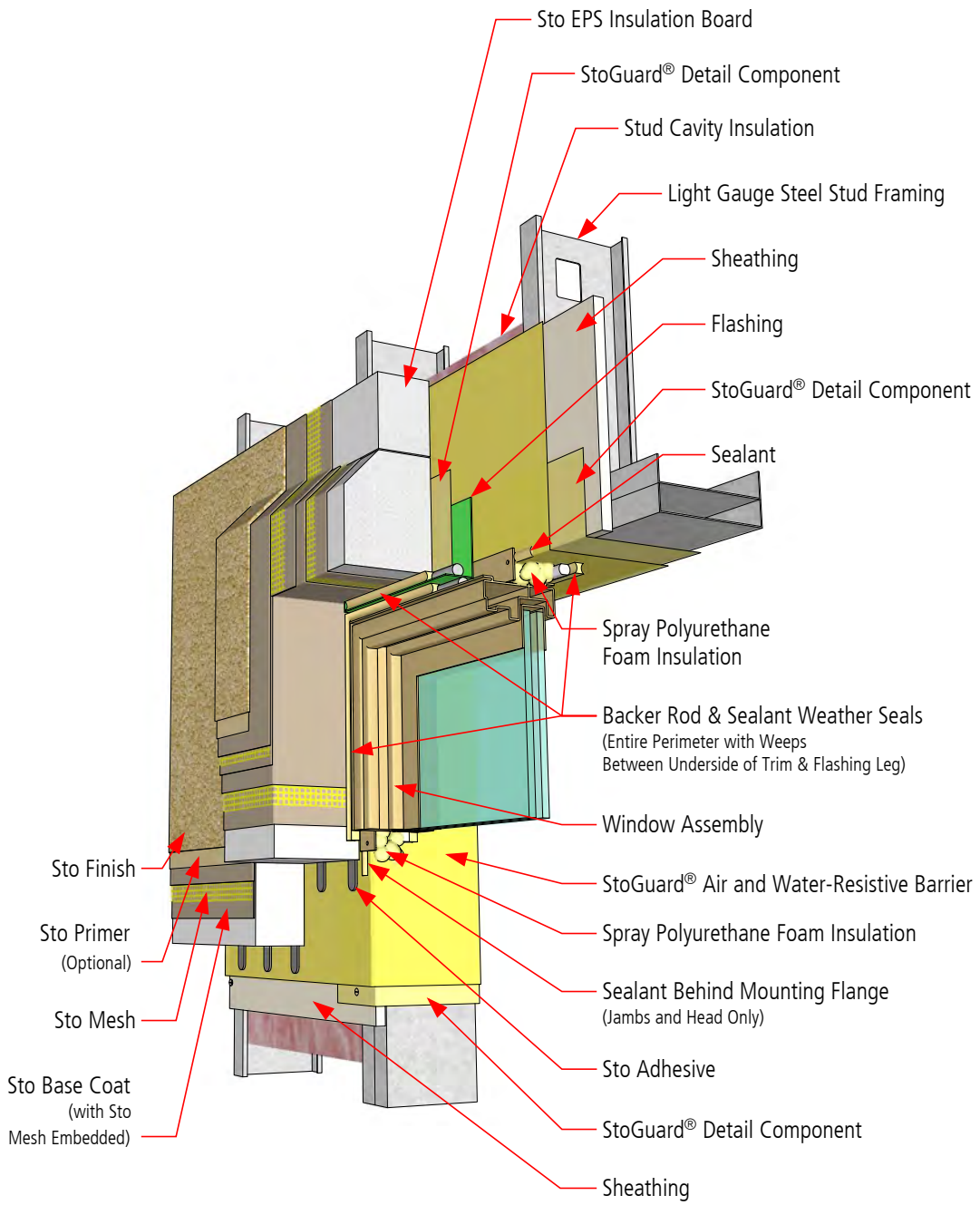
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Flanged Window-Head

Detail No.: 52s.24B-3
Date: June 2022



Step 3 - Cladding and Perimeter Weather and Air Seals

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

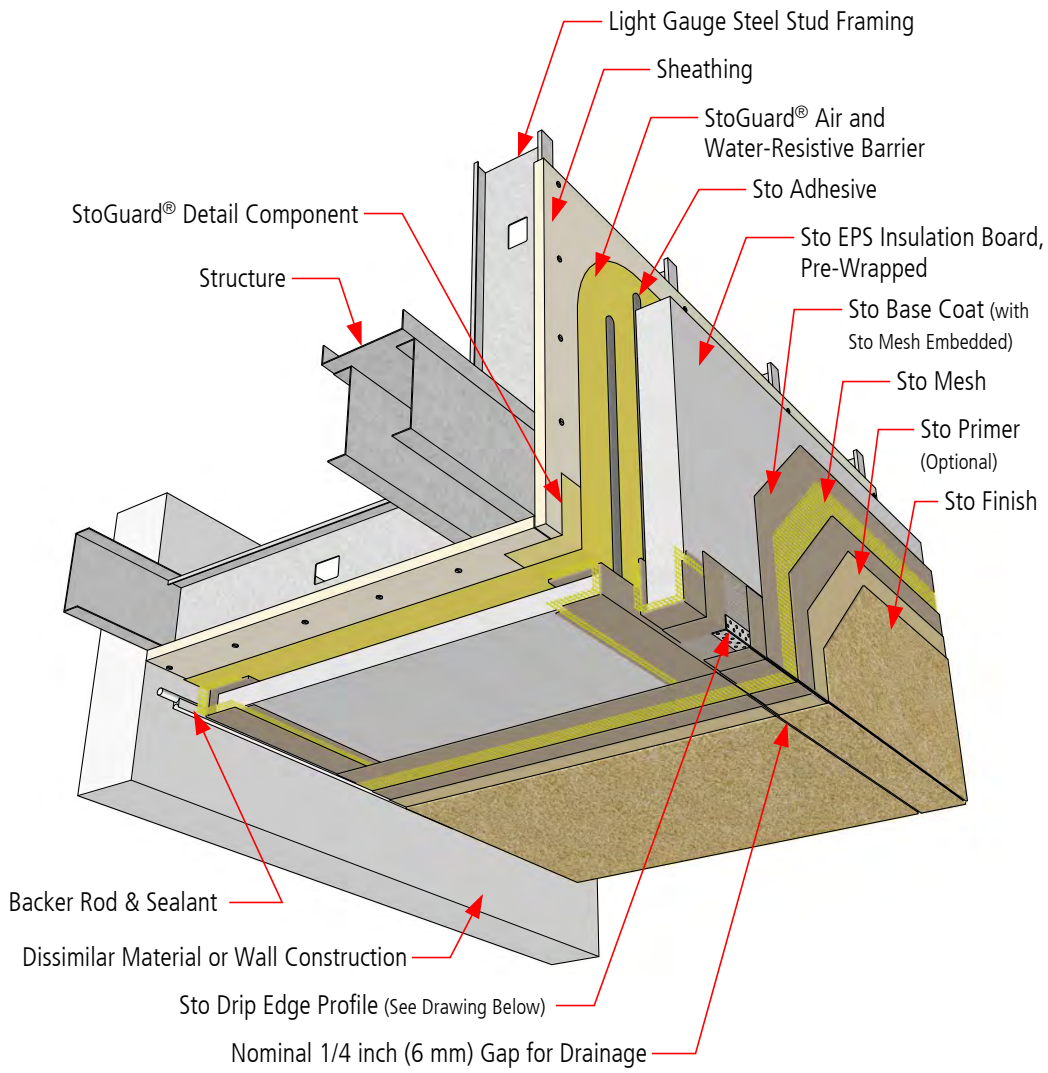
www.stocorp.com

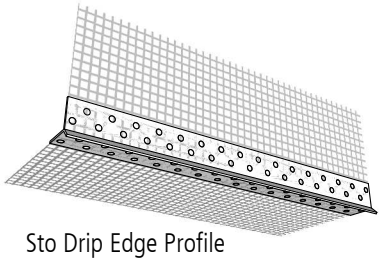
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Soffit: Insulated and Unvented

Detail No.: 52s.30
Date: June 2022





Sto Drip Edge Profile

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

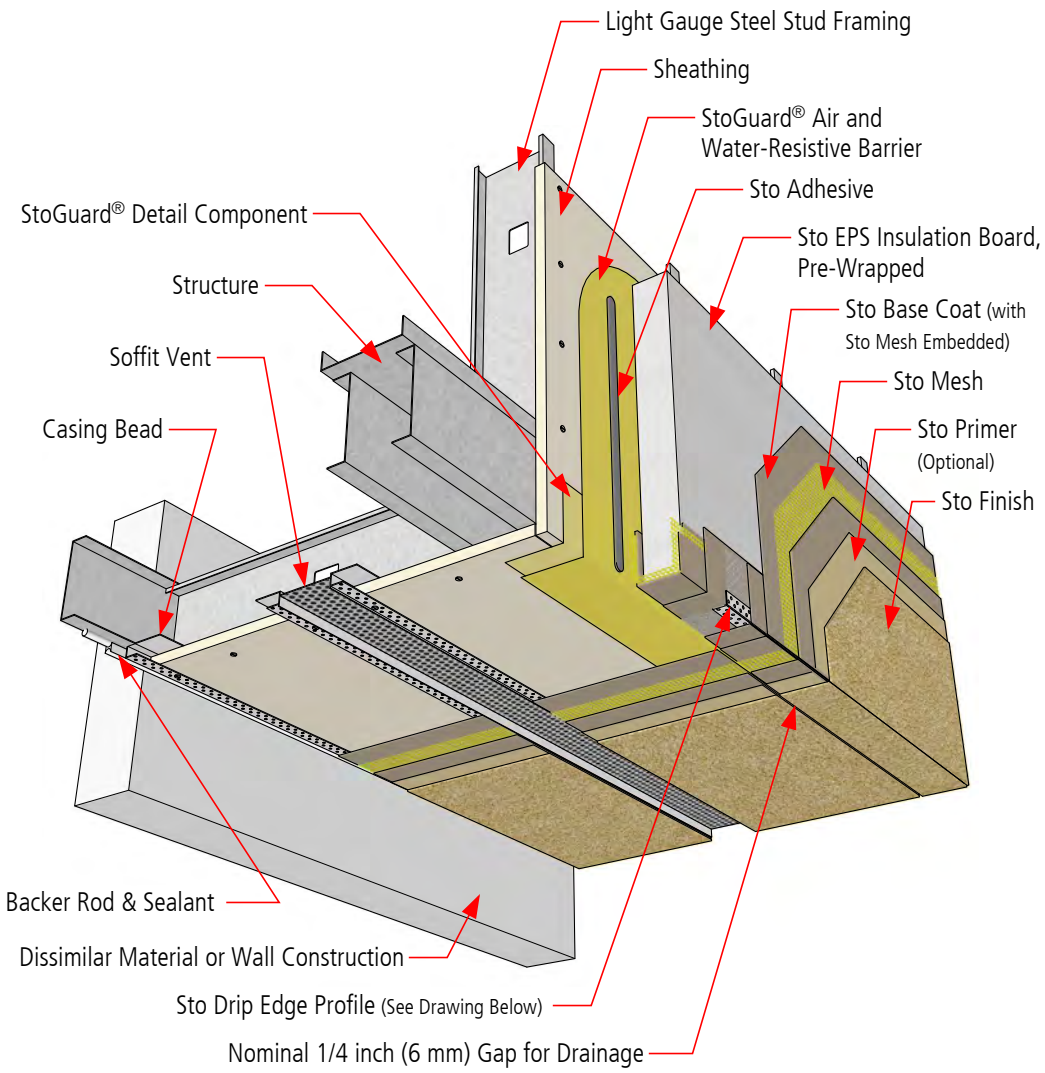
www.stocorp.com

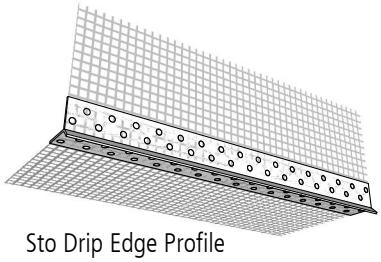
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Soffit: Uninsulated and Vented

Detail No.: 52s.31
Date: June 2022





Sto Drip Edge Profile

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

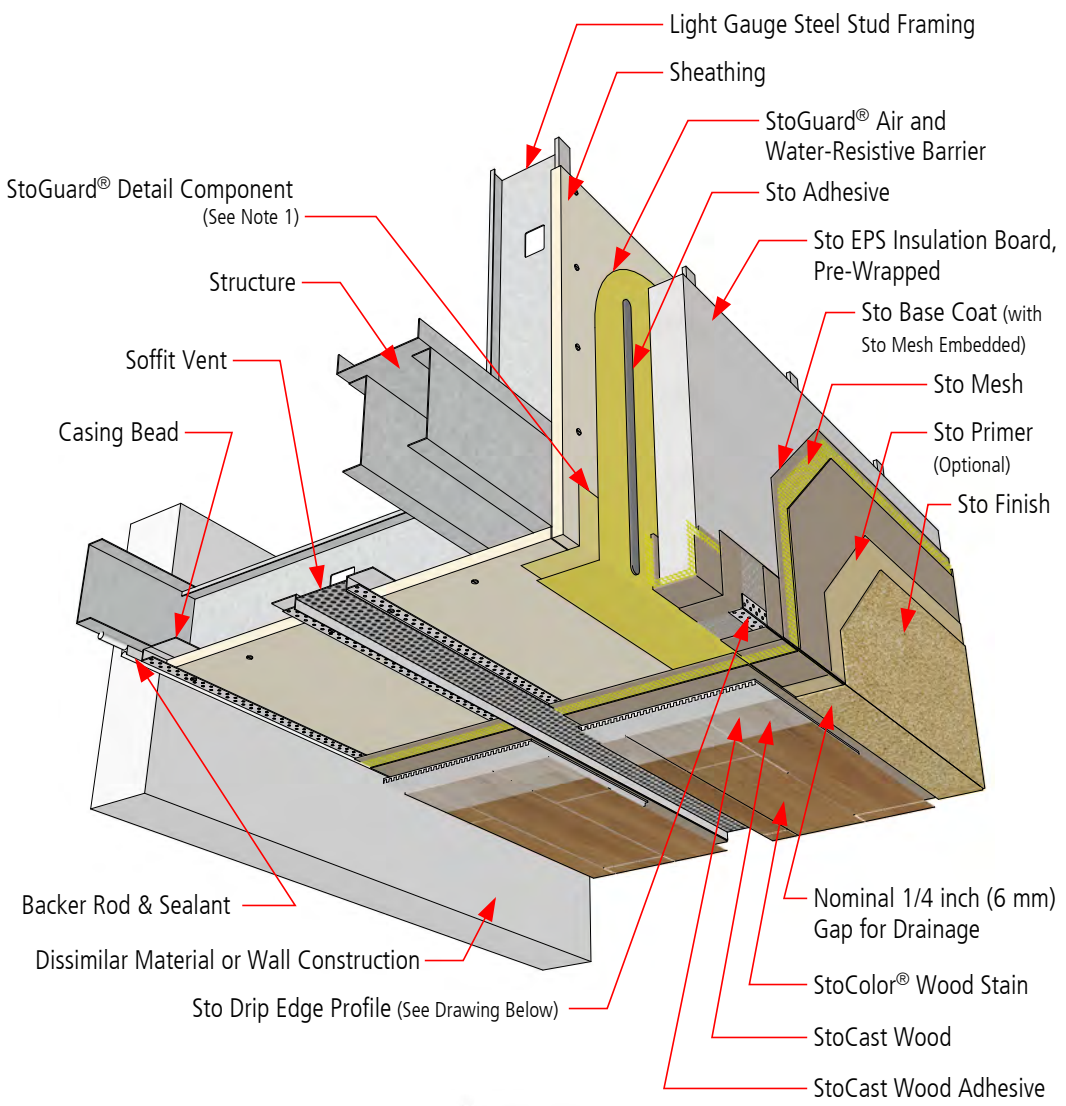
www.stocorp.com

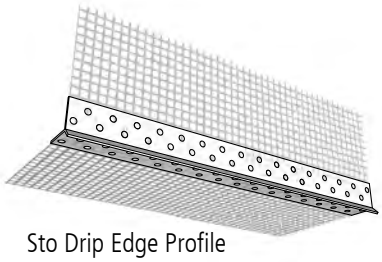
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Soffit: Uninsulated and Vented

Detail No.: 52s.31 SCW
Date: May 2023





Sto Drip Edge Profile

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved.

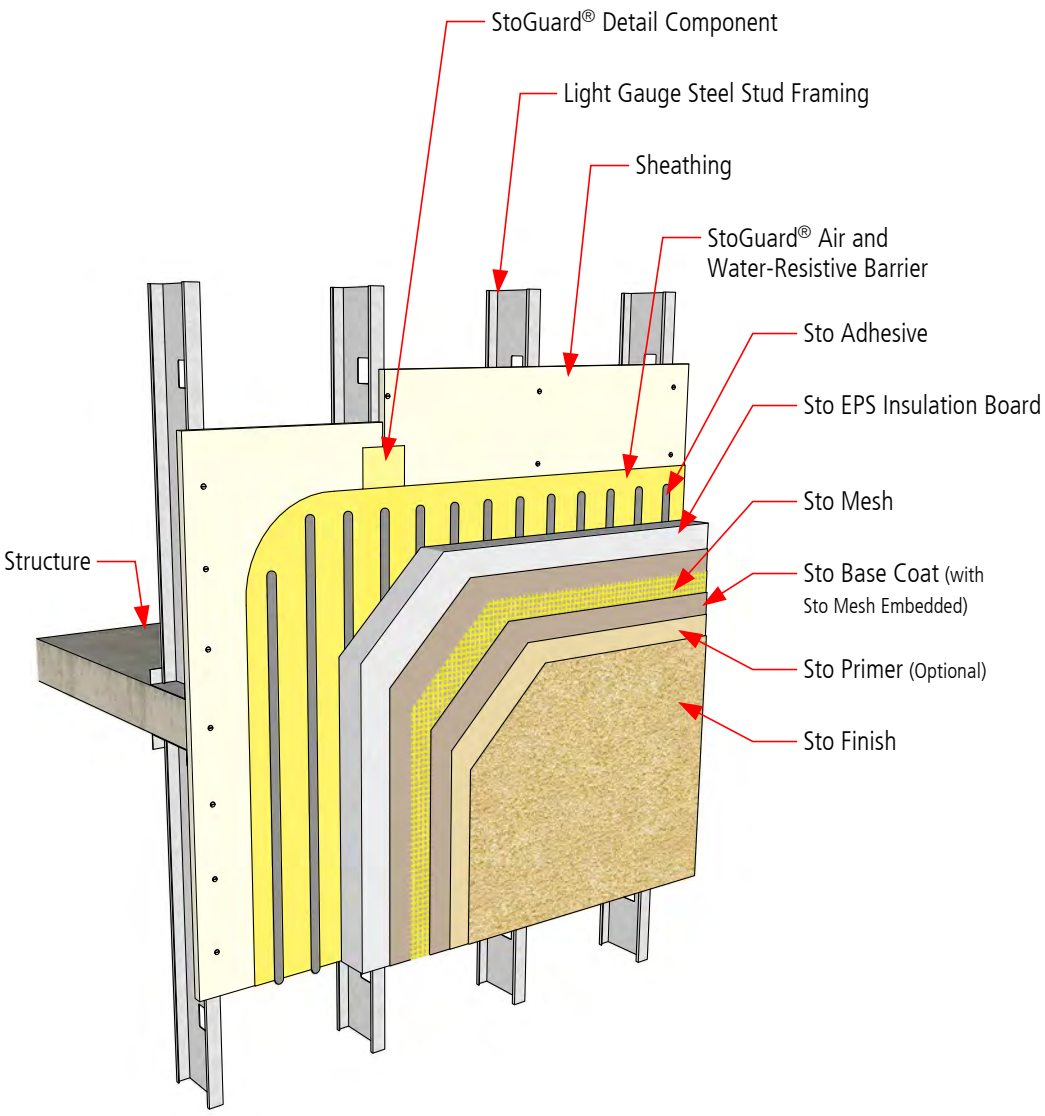
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Floor Line Without Deflection

Detail No.: 52s.40
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

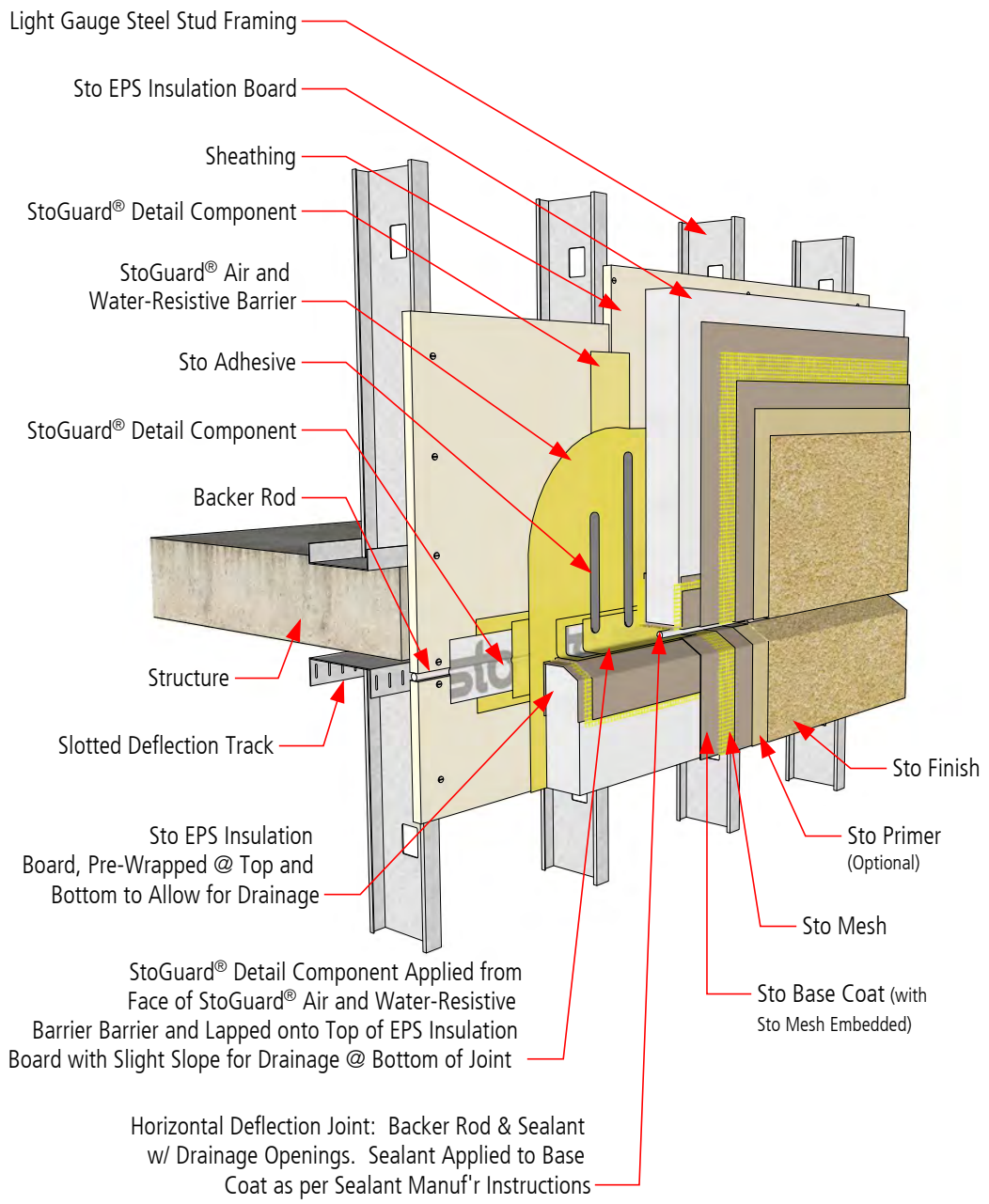
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Floor Line With Deflection - Concealed Flashing and Drainage at Floor Line

Detail No.: 52s.41A
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

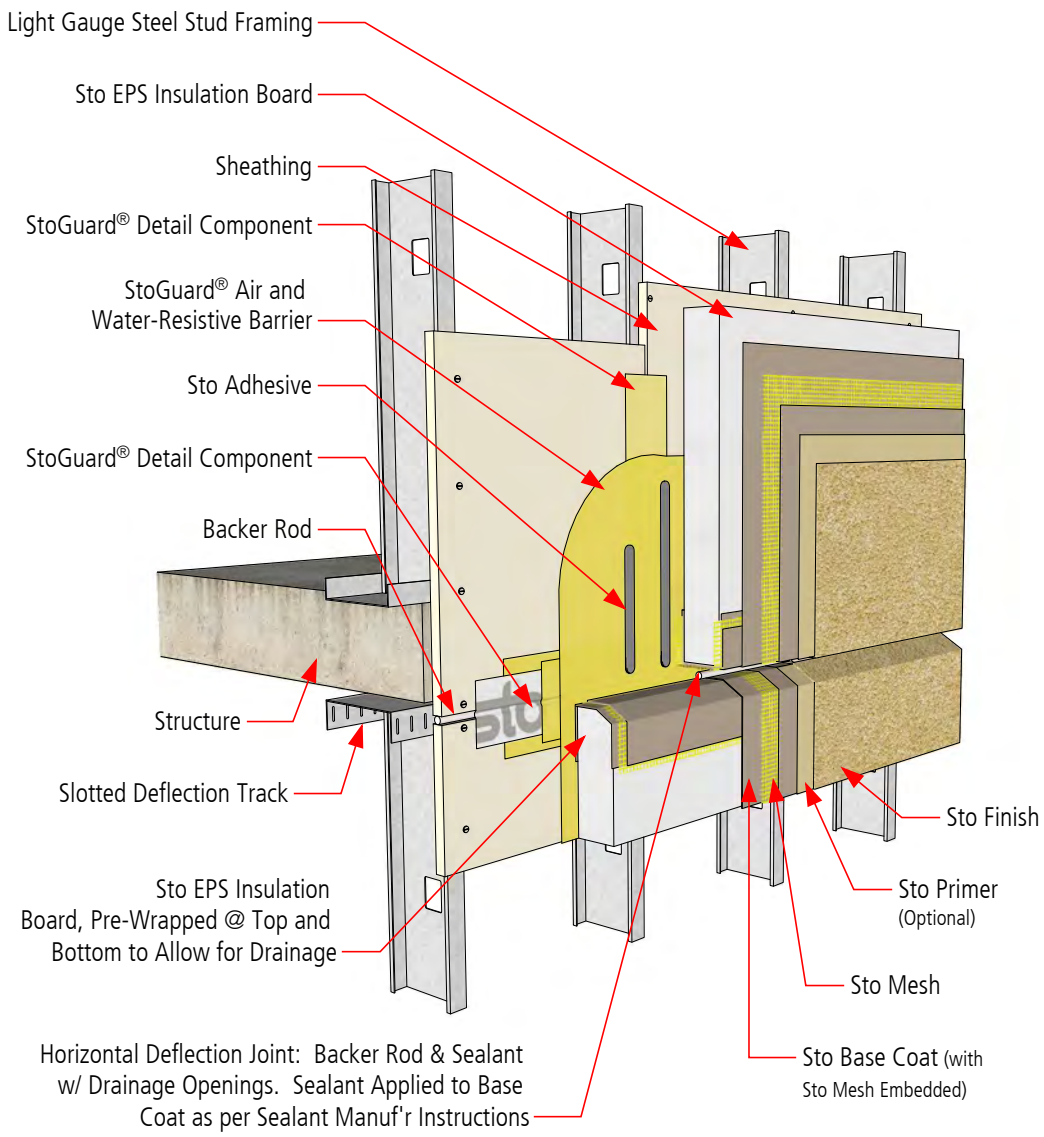
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Floor Line With Deflection - No Drainage at Floor Line

Detail No.: 52s.41B
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

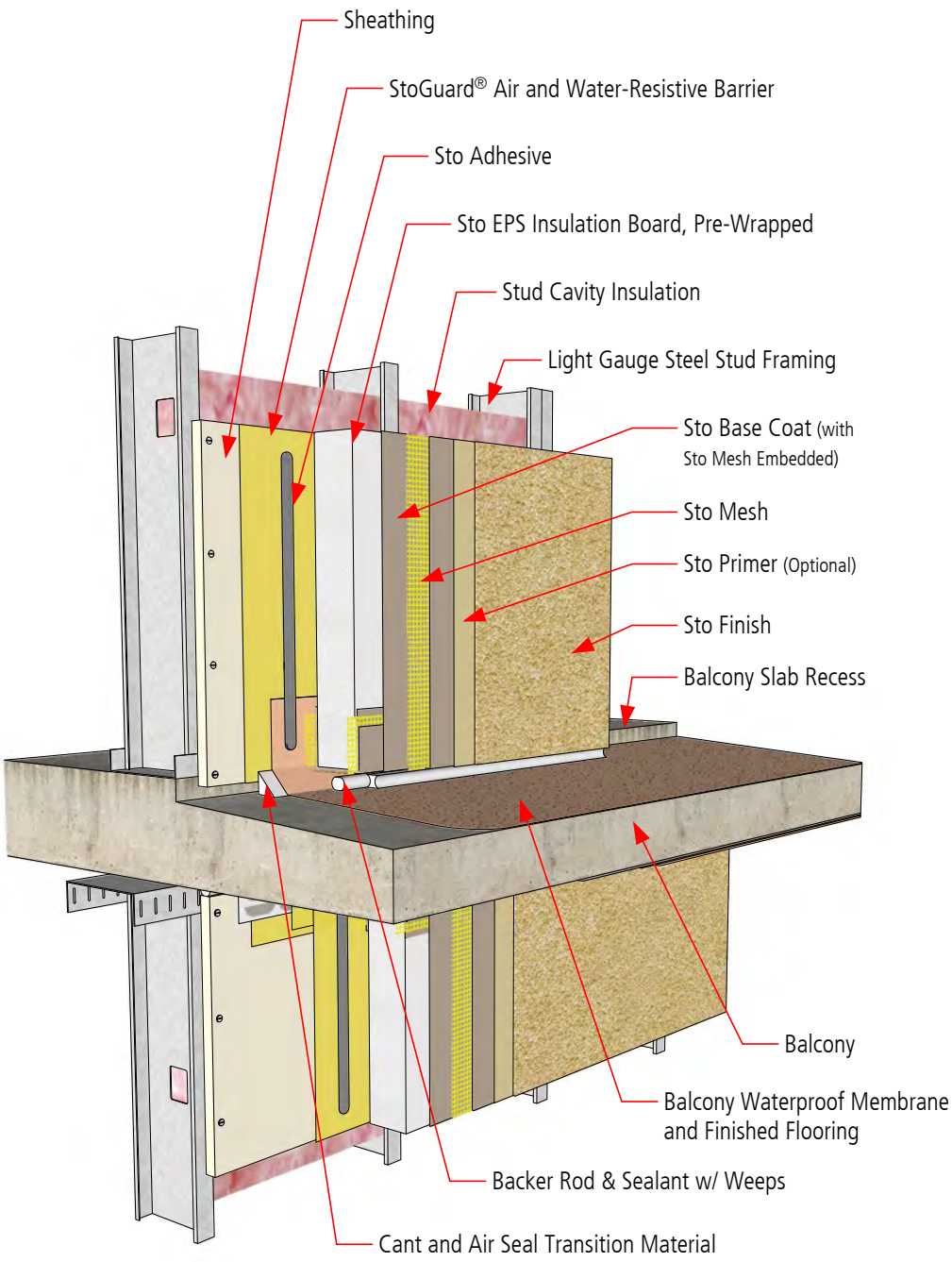
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Balcony Floor/Wall

Detail No.: 52s.42A
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

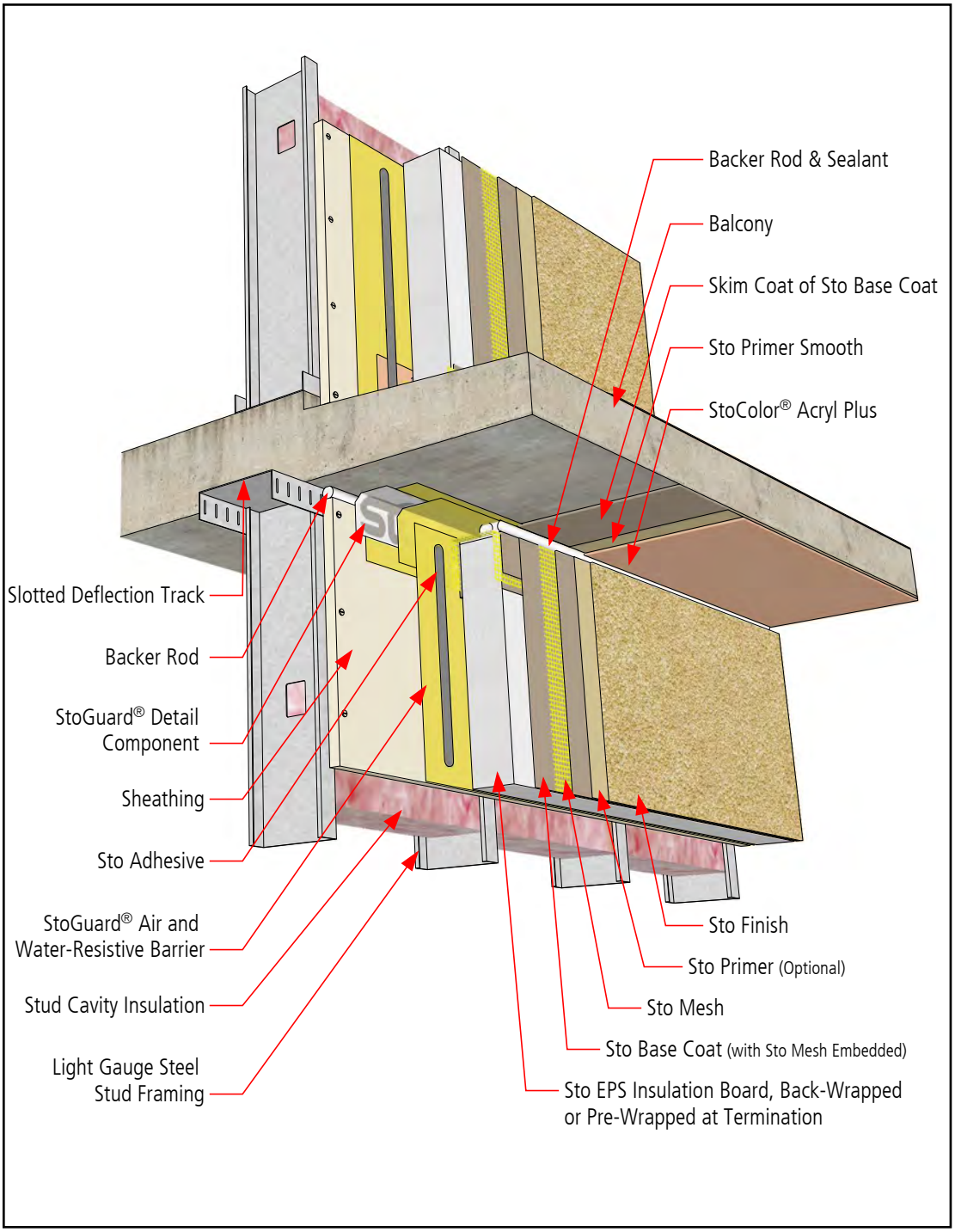
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Balcony Ceiling/Wall

Detail No.: 52s.42B
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

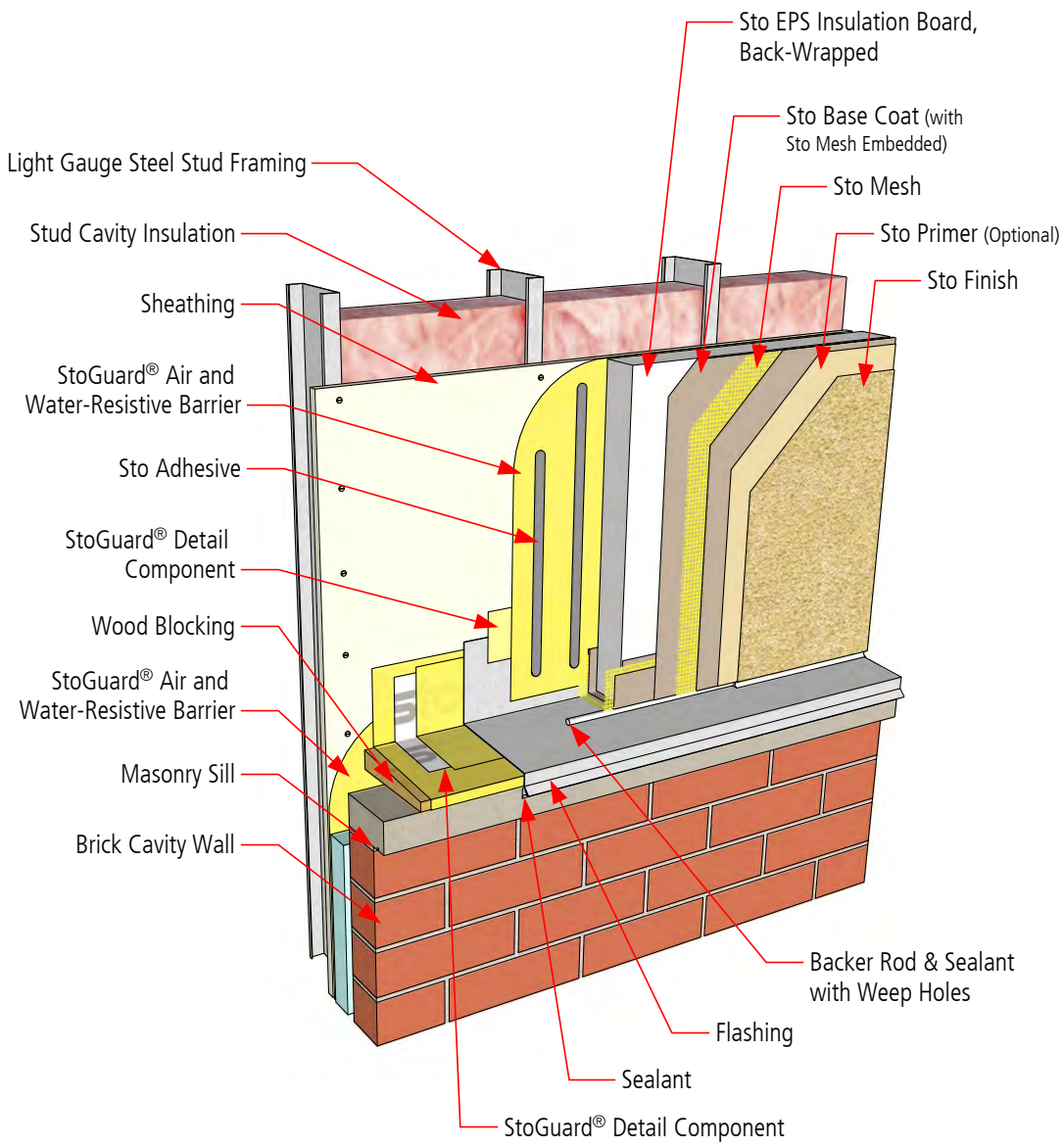
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Horizontal Termination at Dissimilar Cladding

Detail No.: 52s.50
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

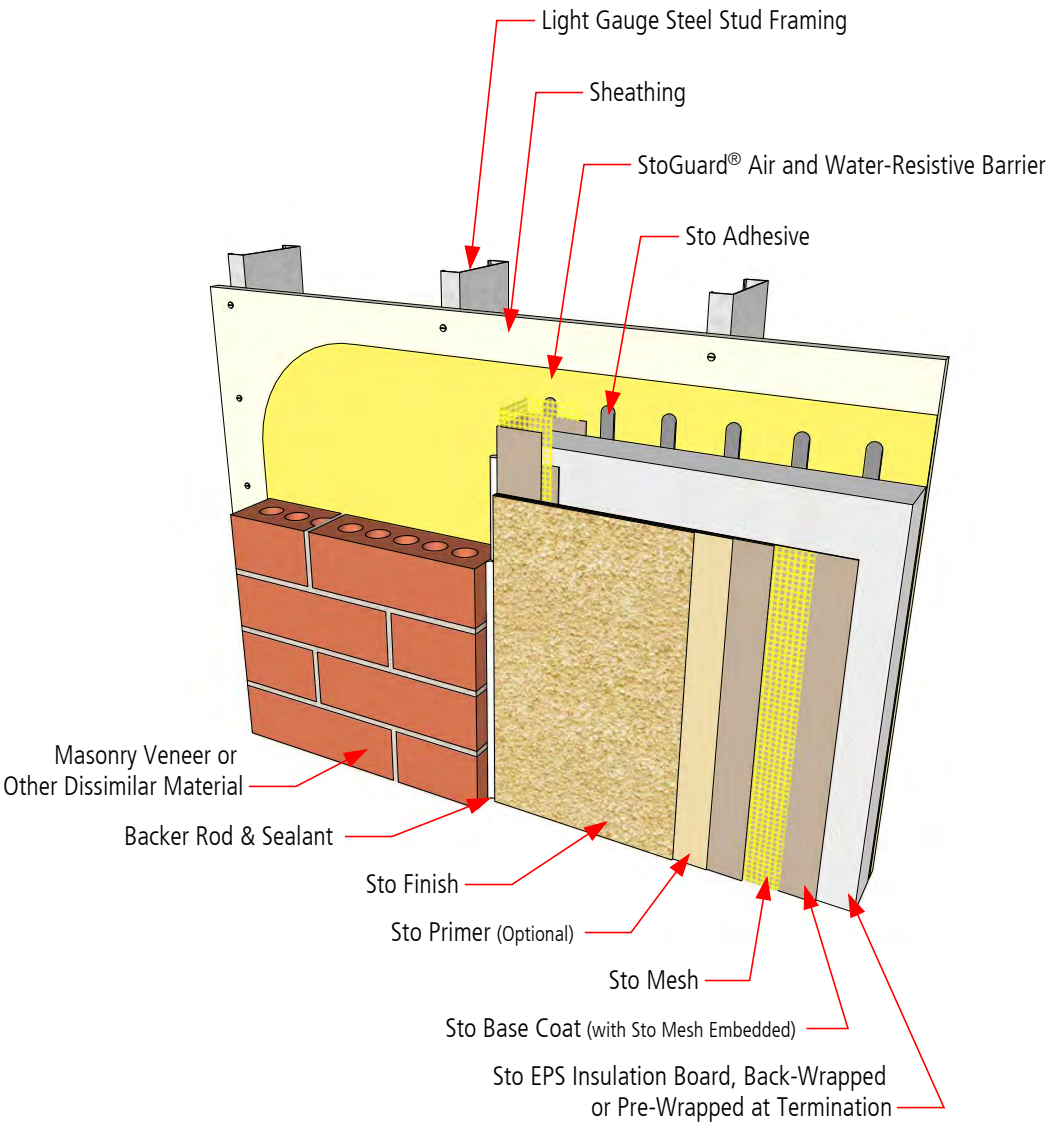
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Vertical Termination at Dissimilar Cladding

Detail No.: 52s.51A
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

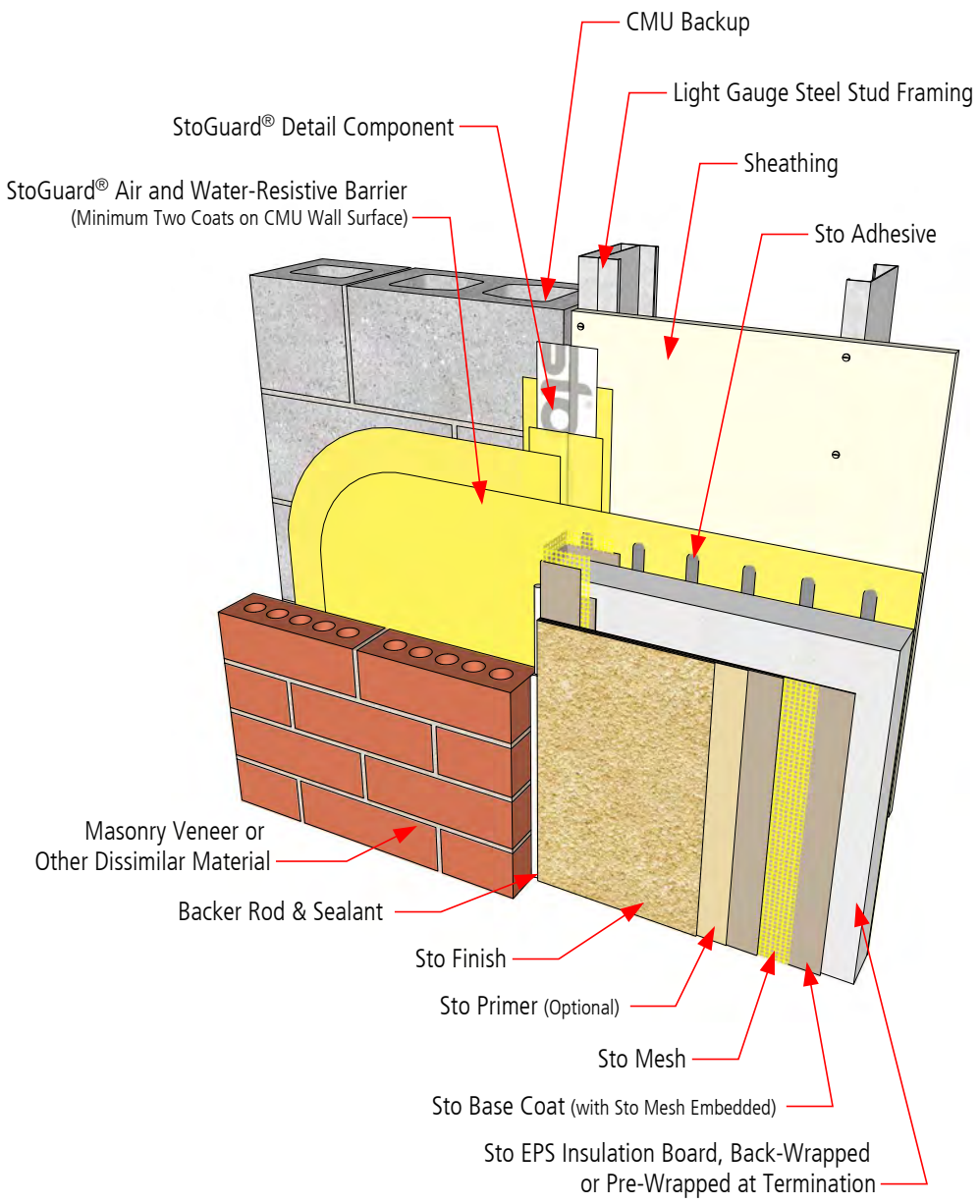
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Vertical Termination at Dissimilar Backup Wall Construction

Detail No.: 52s.51B
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

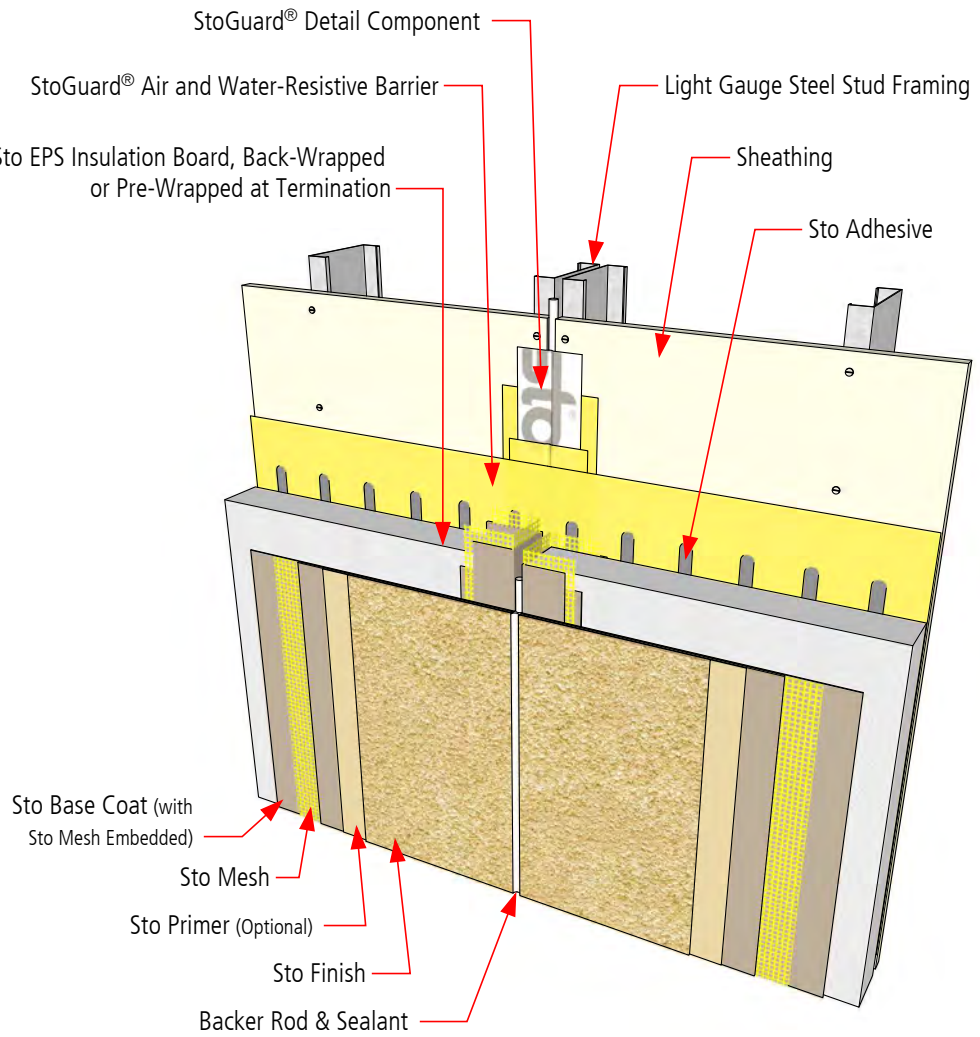
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Vertical Expansion Joint in Back-Up Wall

Detail No.: 52s.52A
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

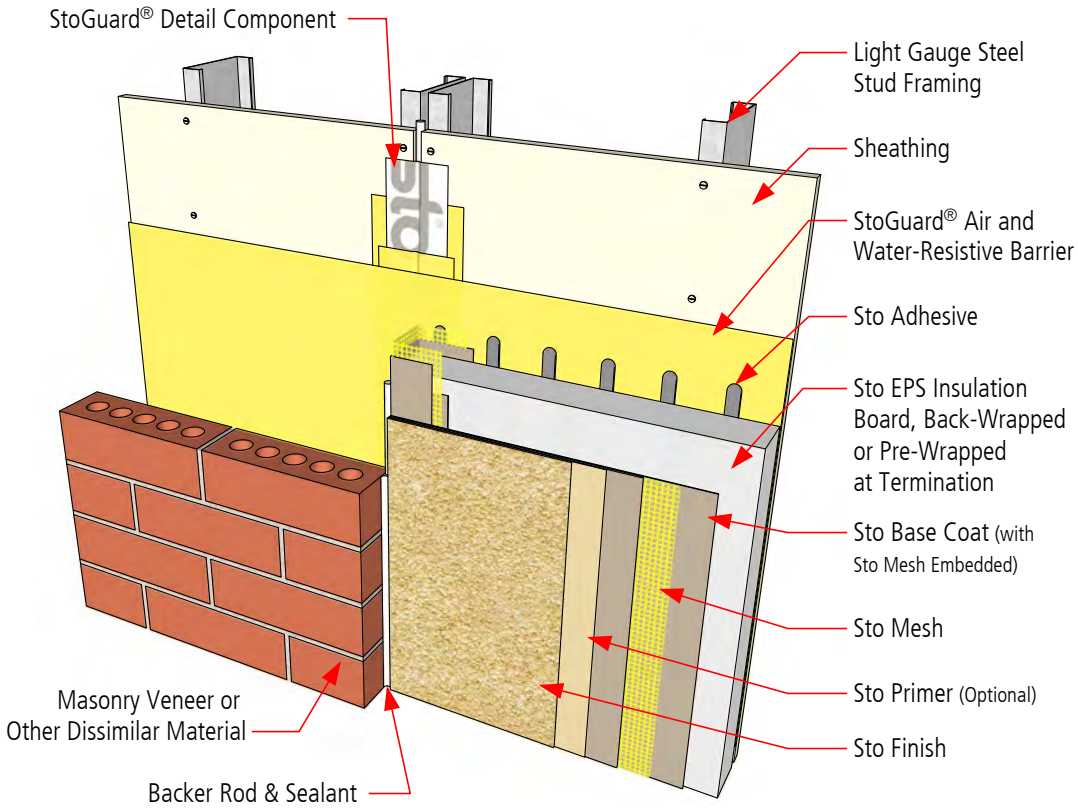
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Vertical Expansion Joint in Back-Up Wall, StoTherm ci and Dissimilar Cladding

Detail No.: 52s.52B
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

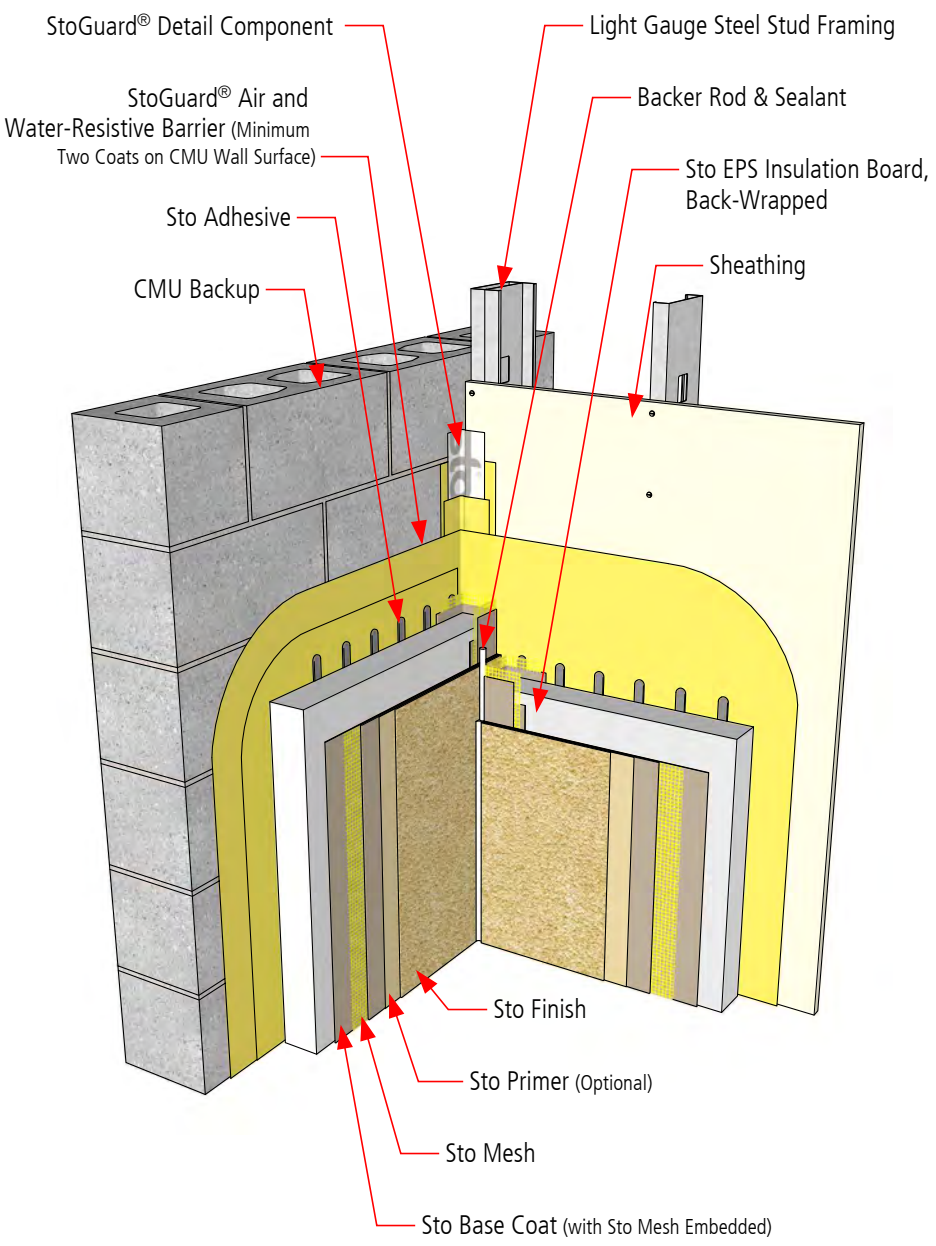
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Inside Corner with Dissimilar Backup Wall

Detail No.: 52s.53
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

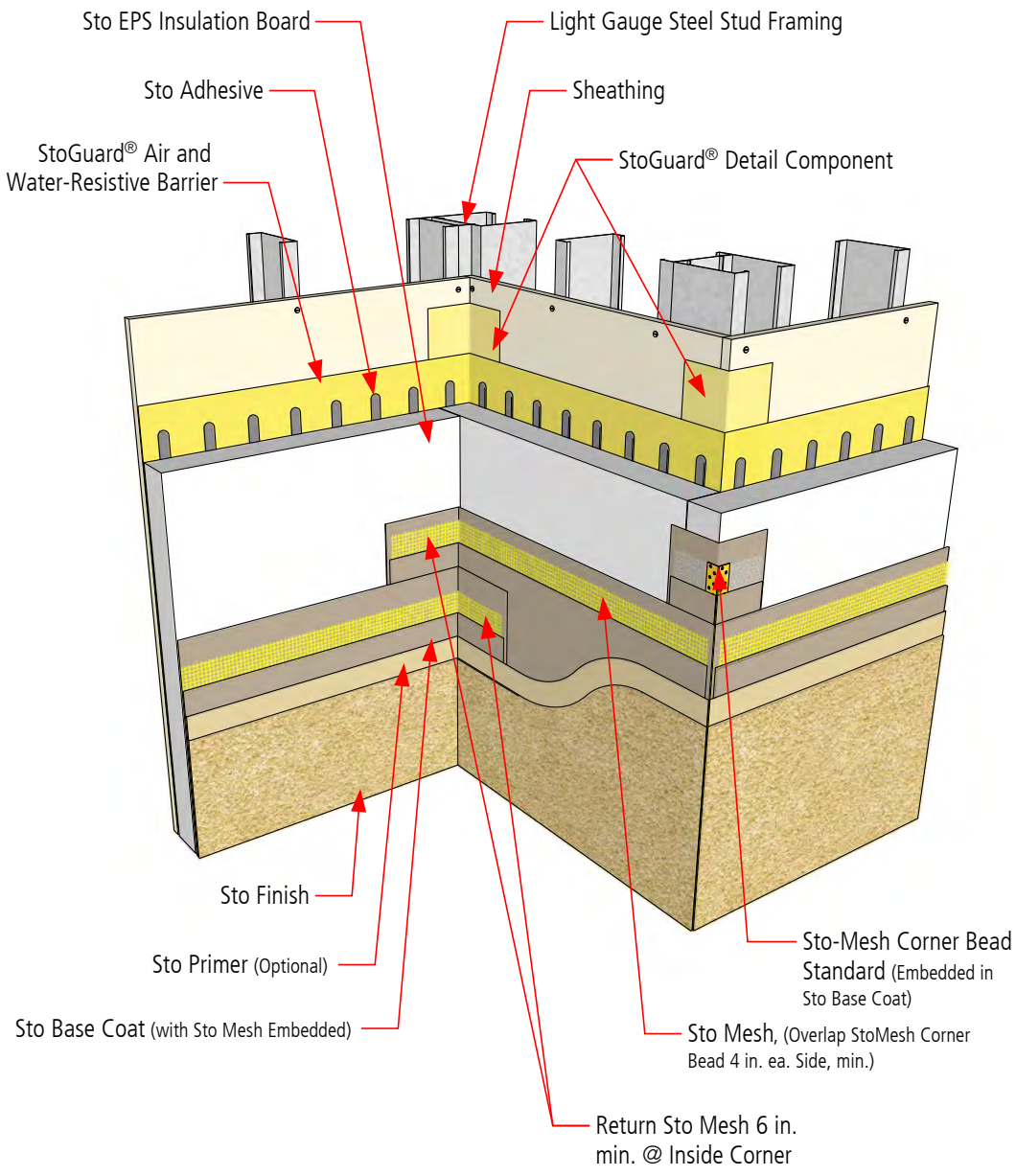
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Inside and Outside Corner with Common Substrate and StoMesh Corner Bead Reinforcement

Detail No.: 52s.54A
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

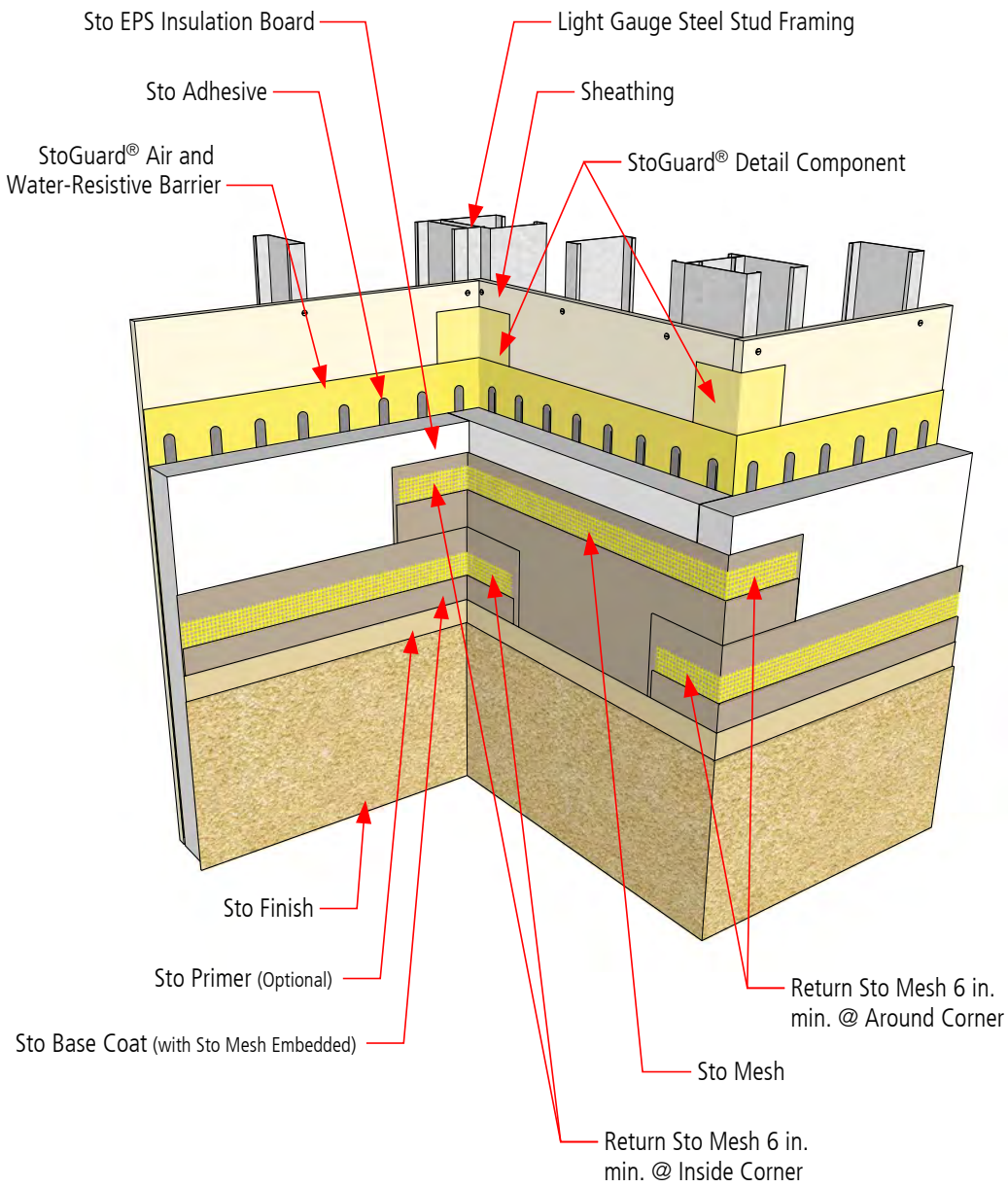
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Inside and Outside Corner with Common Substrate and Sto Mesh Reinforcement

Detail No.: 52s.54B
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

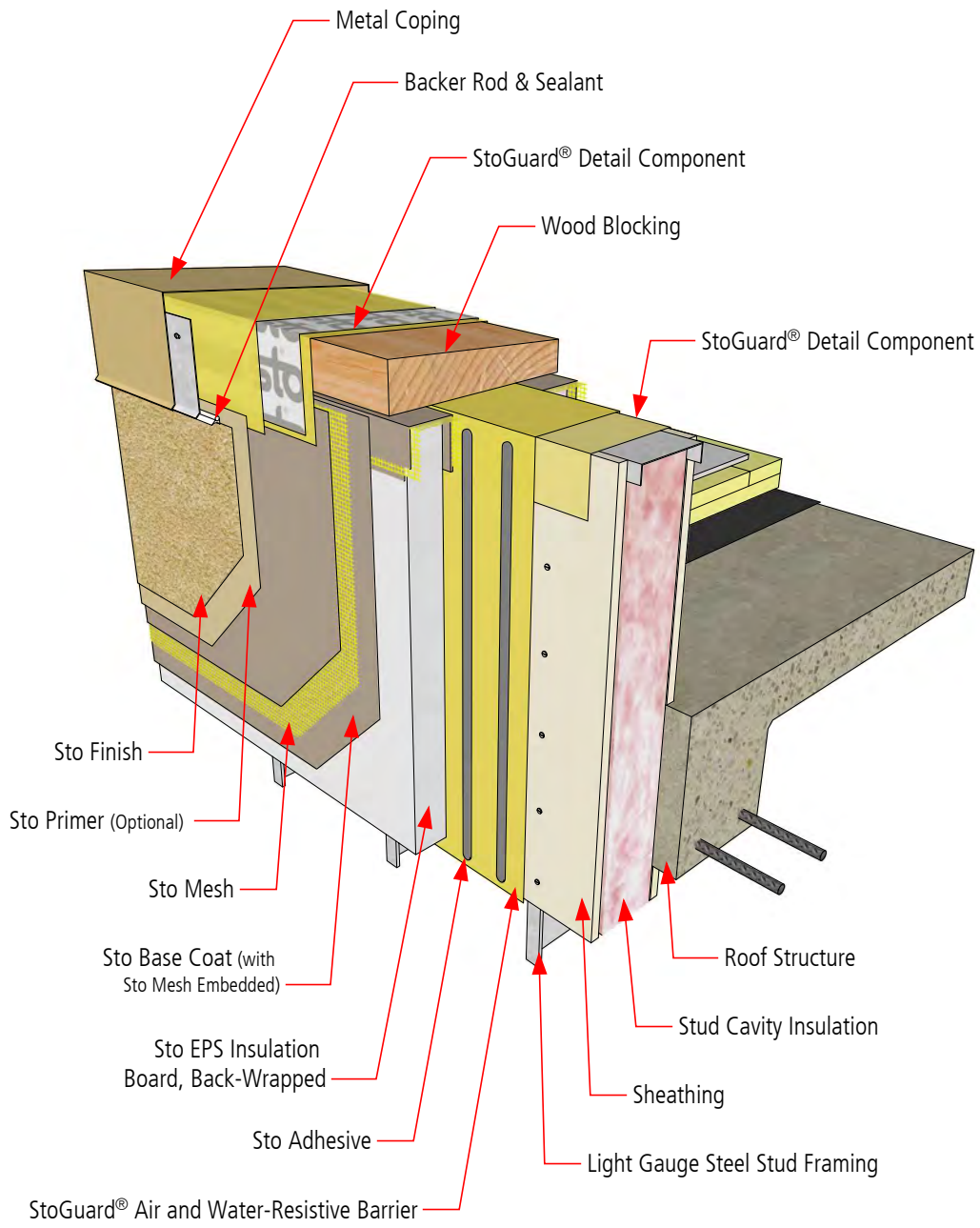
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Termination at Parapet - Front

Detail No.: 52s.60A
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

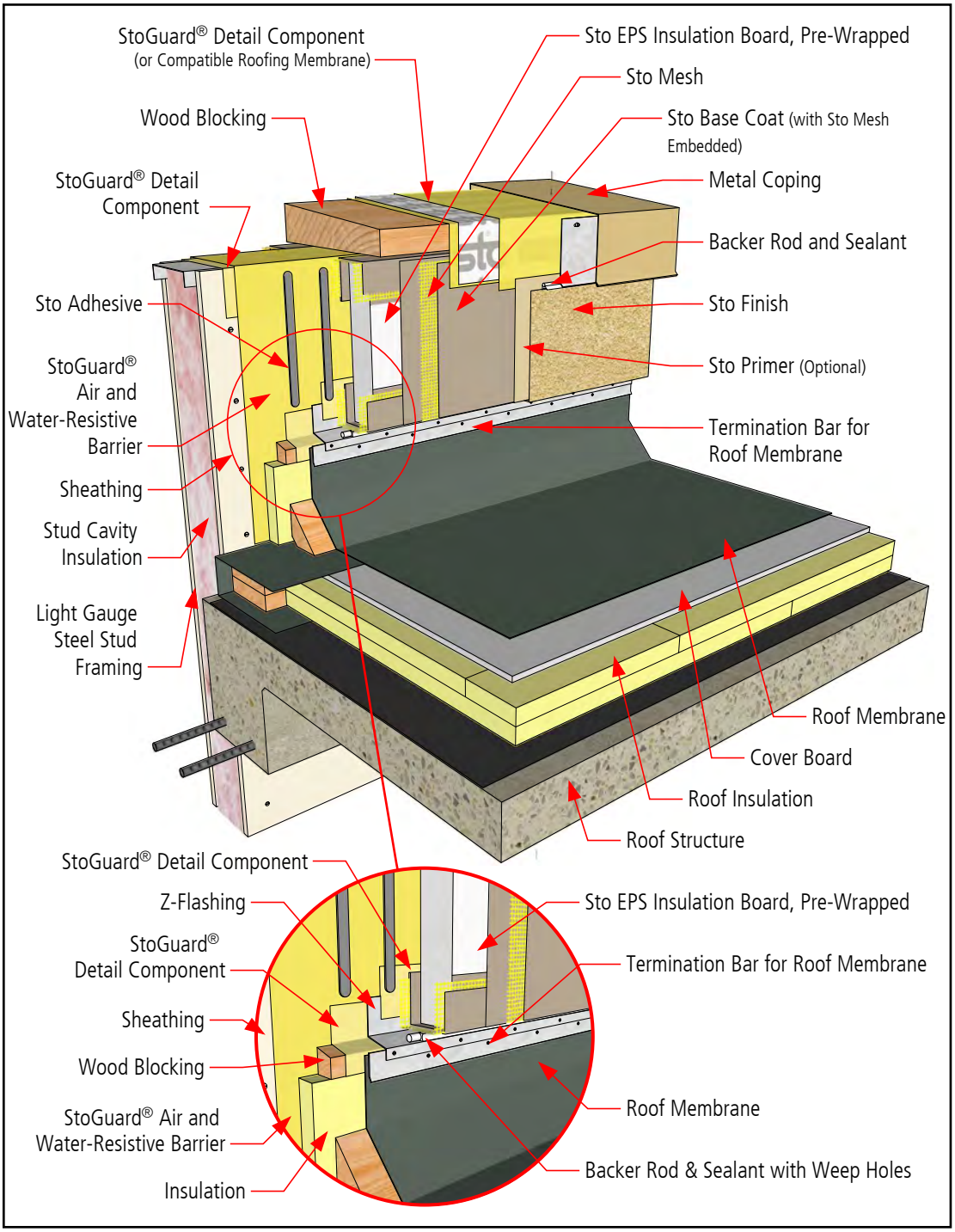
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Termination at Parapet - Back

Detail No.: 52s.60B
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

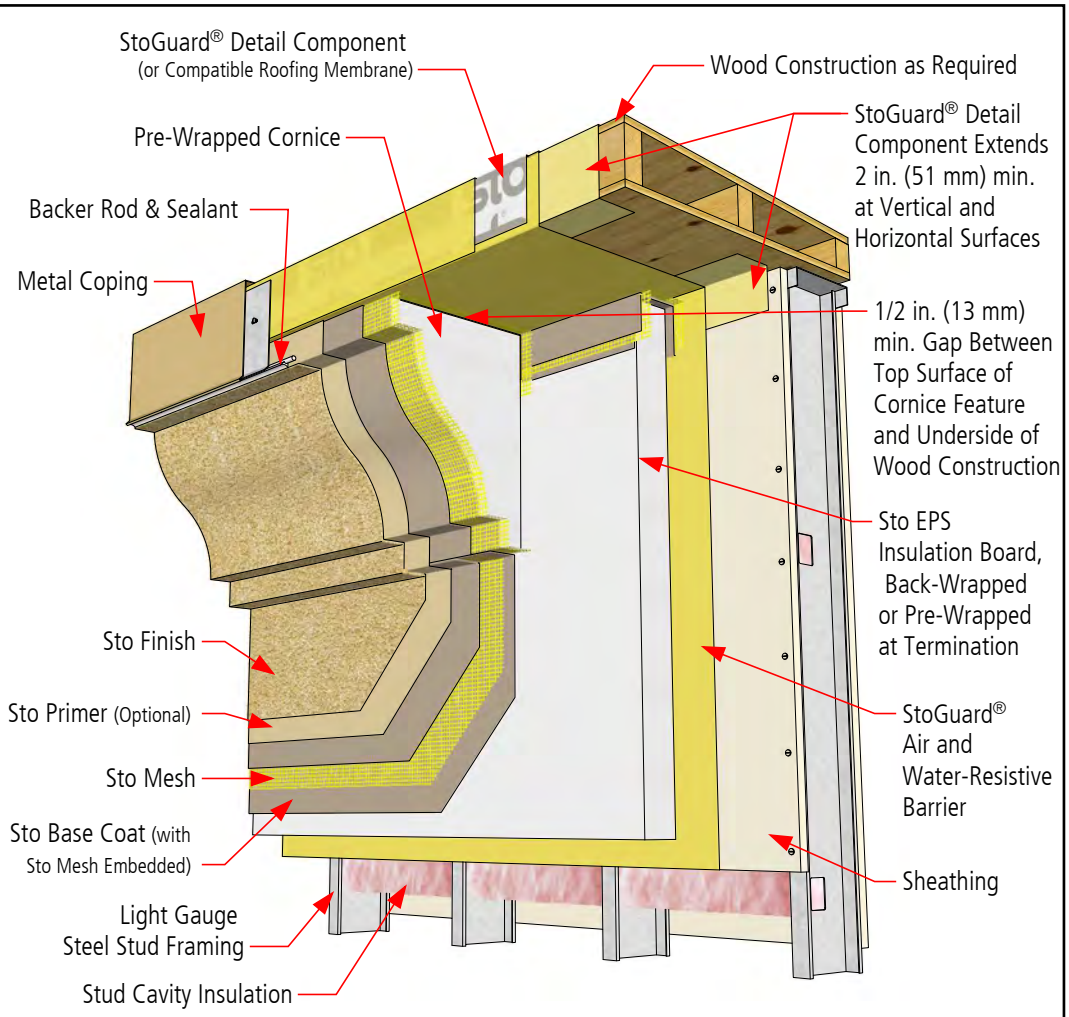
www.stocorp.com

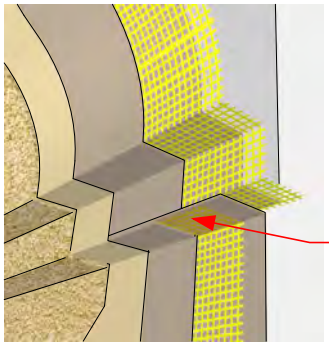
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Parapet with Cornice Feature

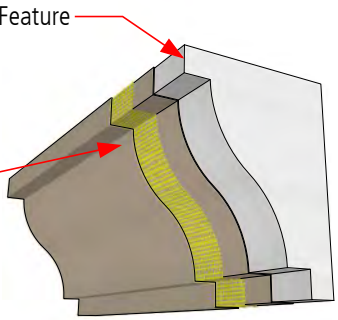
Detail No.: 52s.61
Date: June 2022





Sto Mesh Embedded in Base Coat Laps Sto Mesh on Cornice 2 1/2 in. (64 mm) min.

View of Mesh Overlap



View of Pre-Wrapped Cornice

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

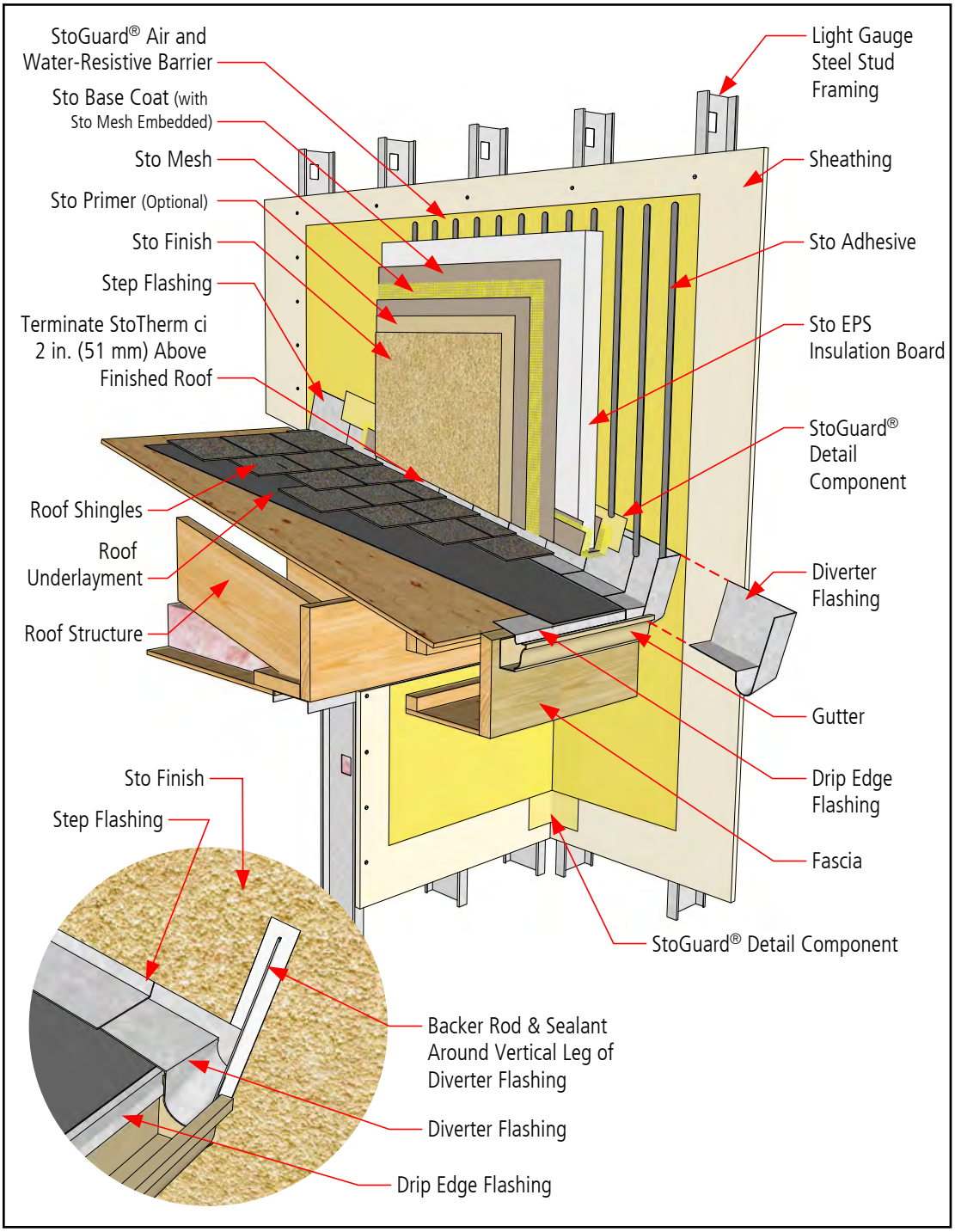
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Diverter Flashing at Roof/Wall Abutment

Detail No.: 52s.62
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

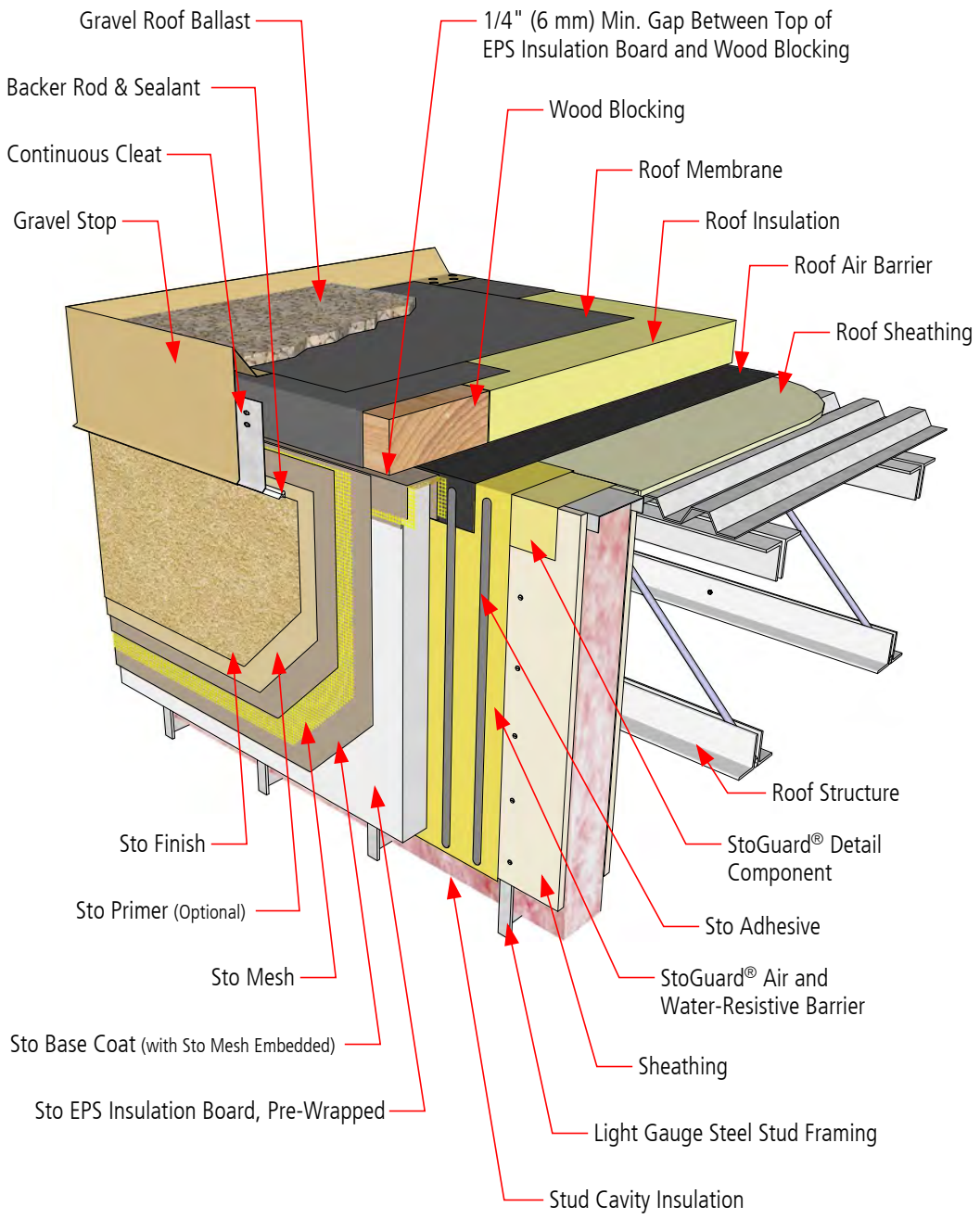
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Gravel Stop

Detail No.: 52s.63
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

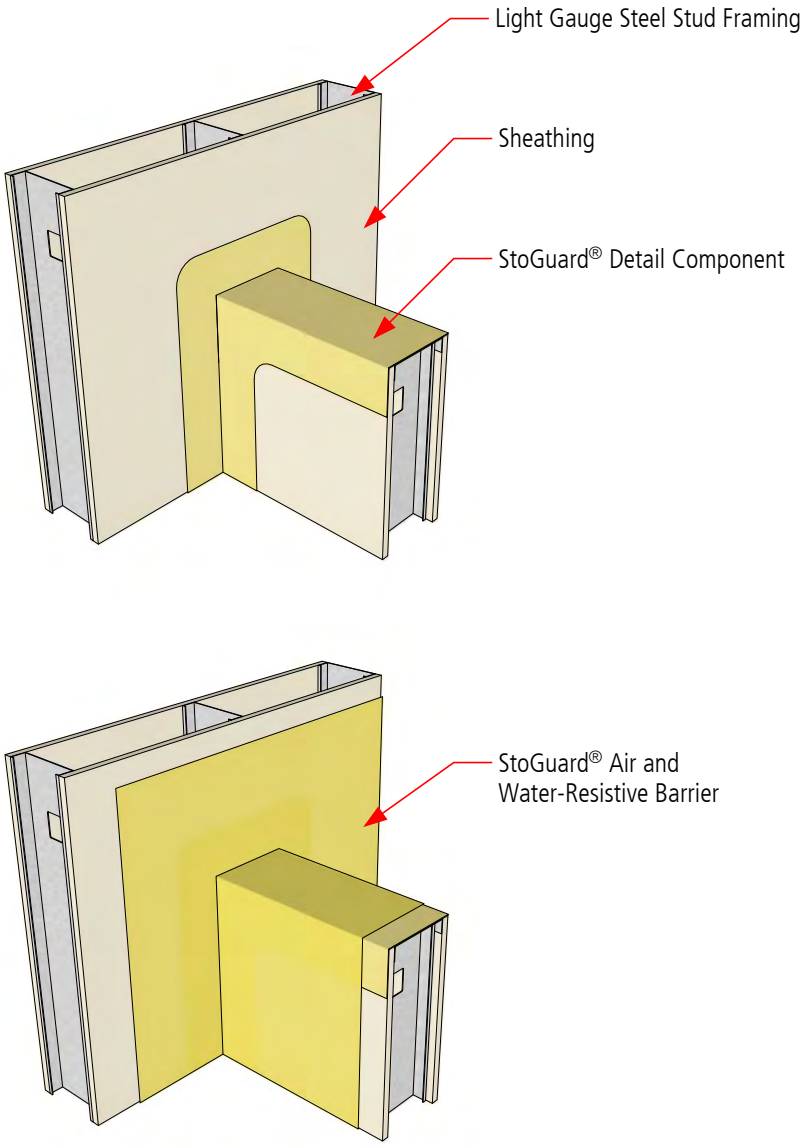
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Saddle Flashing at Lower/Higher Wall Abutment

Detail No.: 52s.64-1
Date: June 2022



Step 1 - Air and Moisture Barrier

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

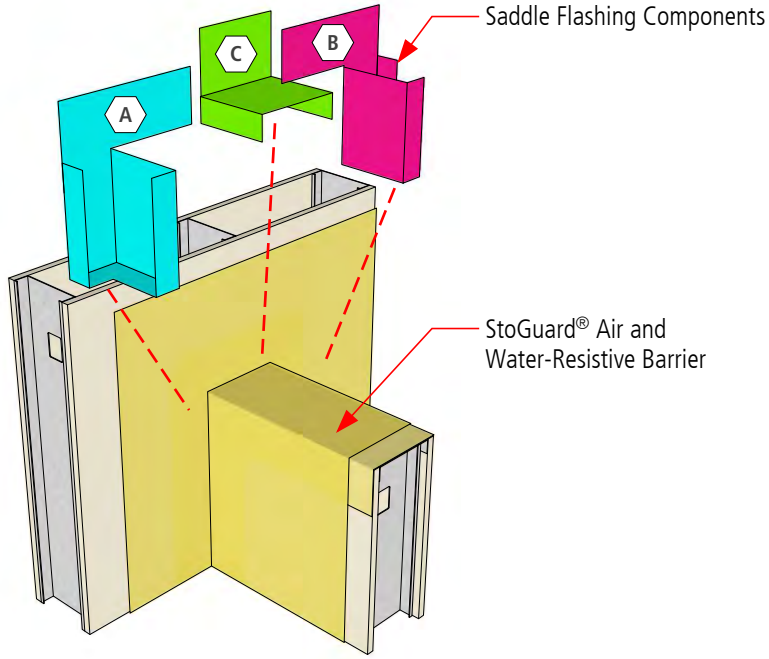
www.stocorp.com

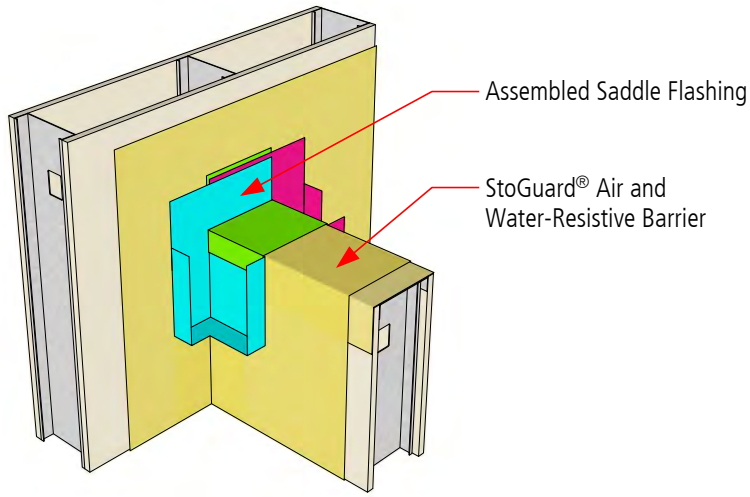
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Saddle Flashing at Lower/Higher Wall Abutment

Detail No.: 52s.64-2
Date: June 2022





Step 2 - Saddle Flashing

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

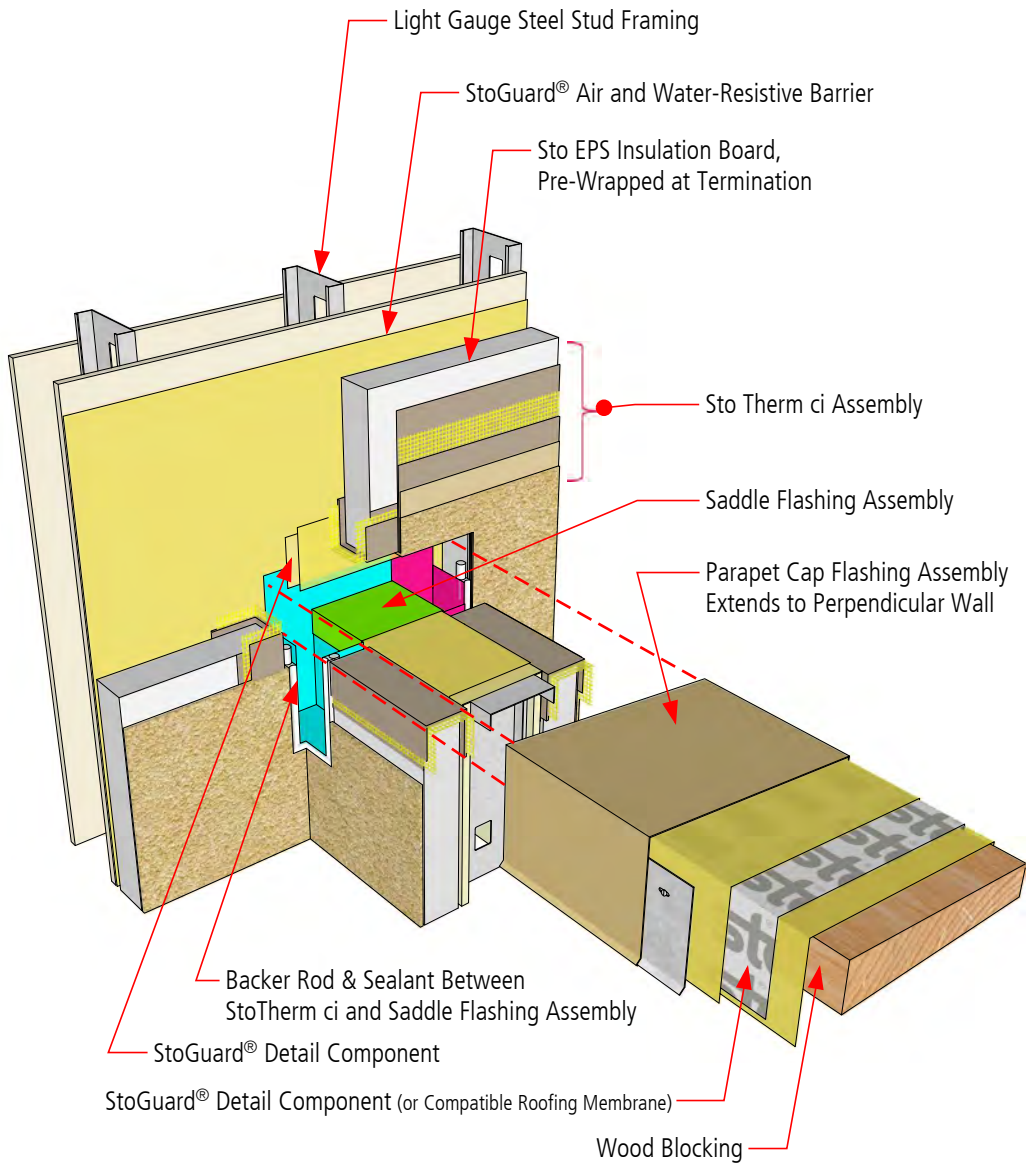
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Saddle Flashing at Lower/Higher Wall Abutment

Detail No.: 52s.64-3
Date: June 2022



Step 3 - Cladding, Coping, and Sealant

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

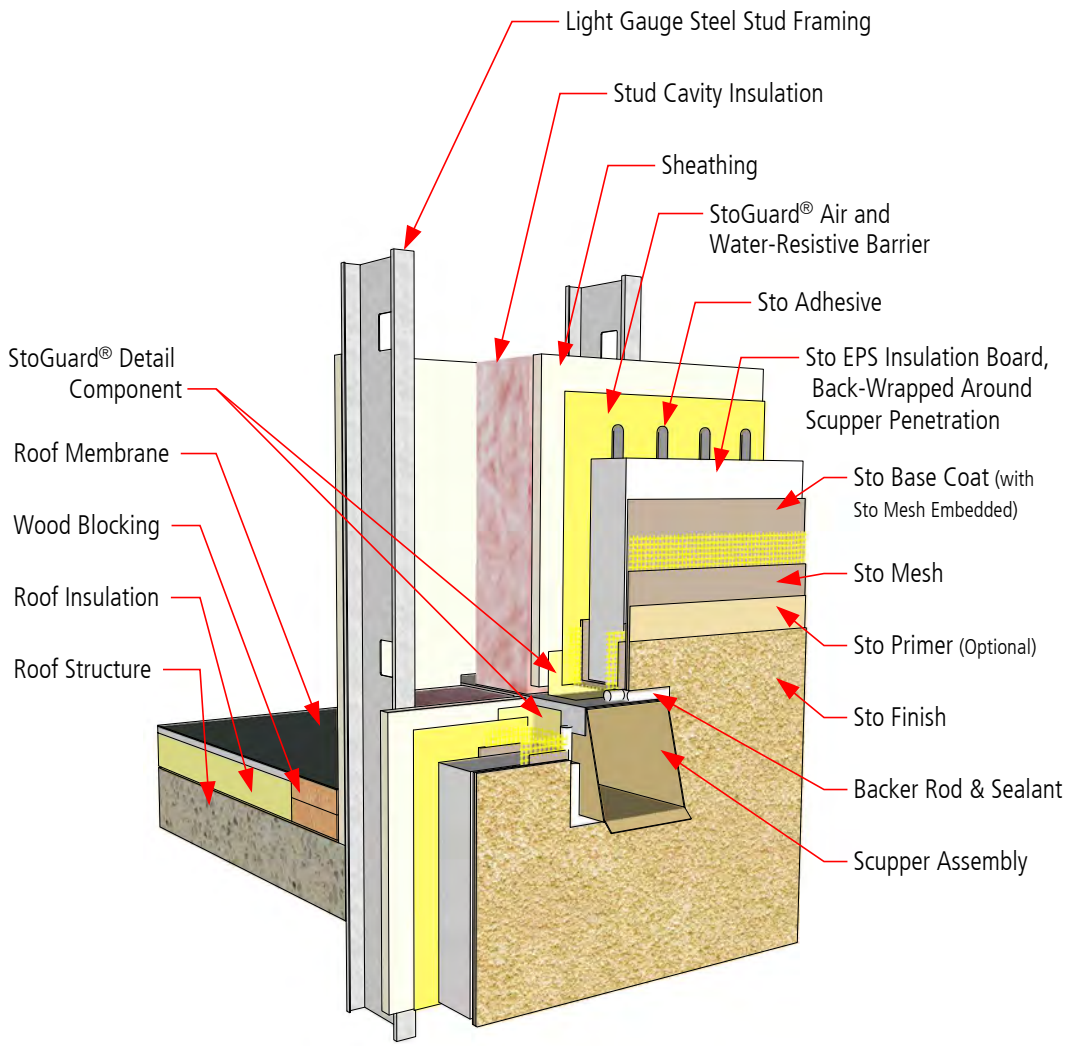
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Scupper Penetration

Detail No.: 52s.65
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

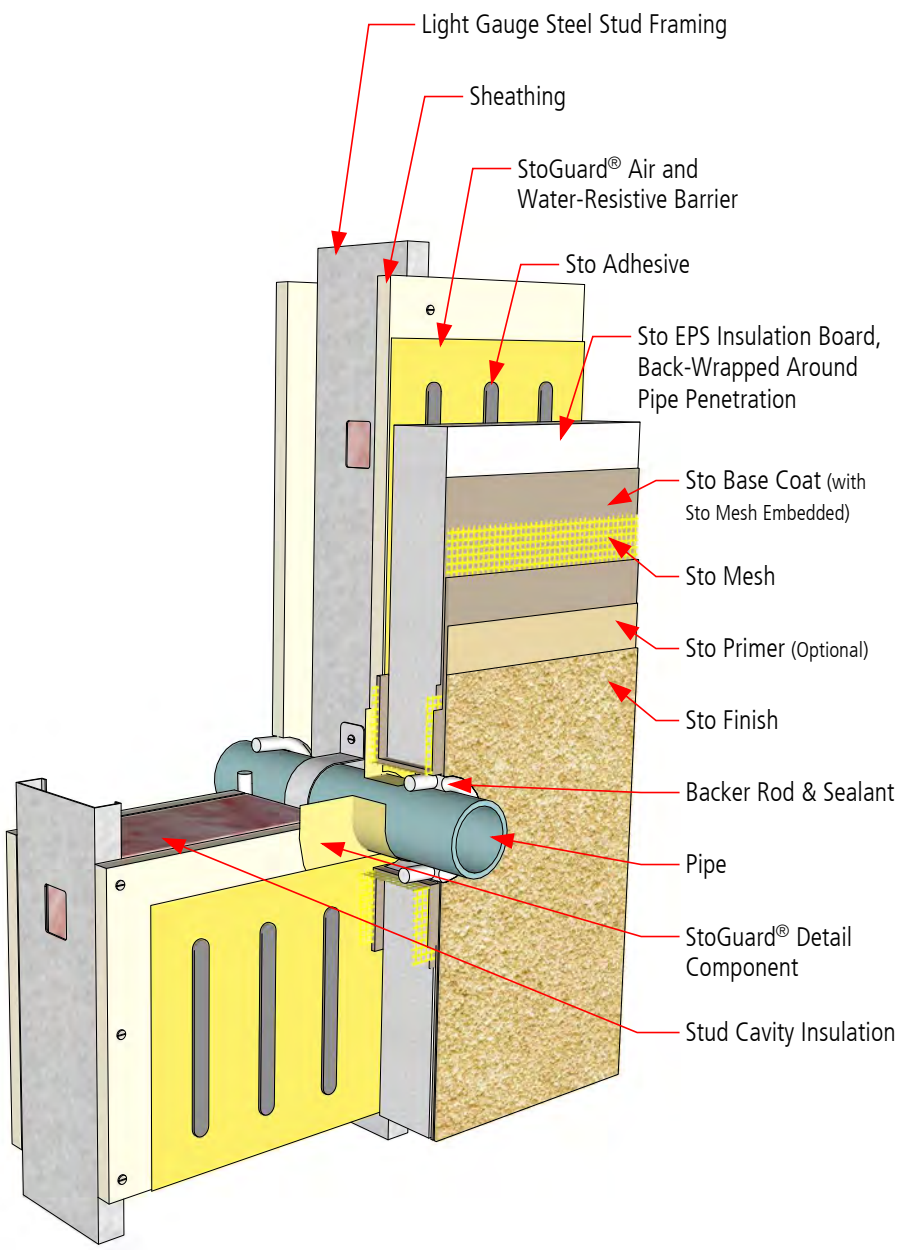
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Pipe Penetration - Precision Cut Sheathing

Detail No.: 52s.70A
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

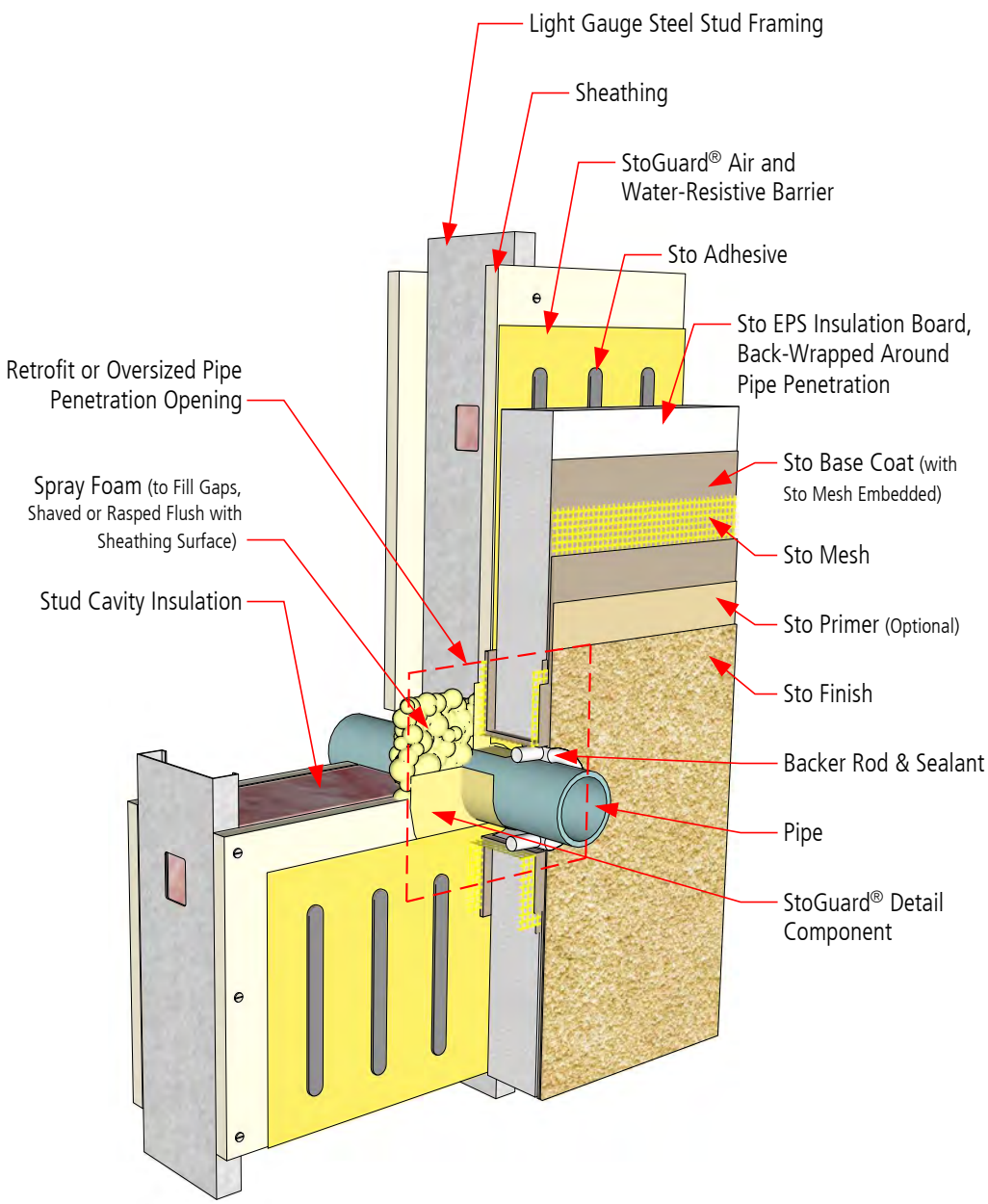
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Pipe Penetration - Rough Cut Sheathing

Detail No.: 52s.70B
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

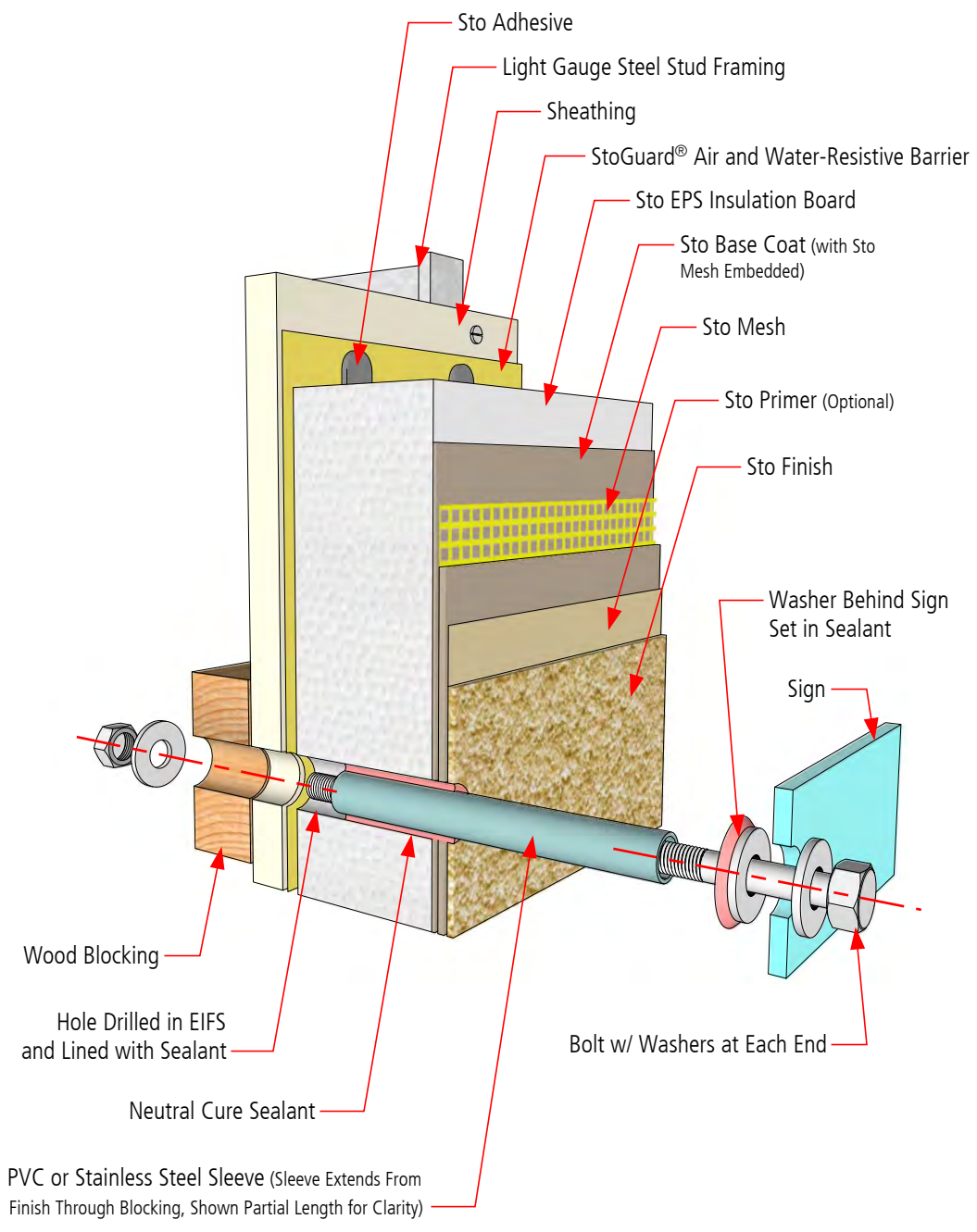
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Sign Attachment

Detail No.: 52s.71
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

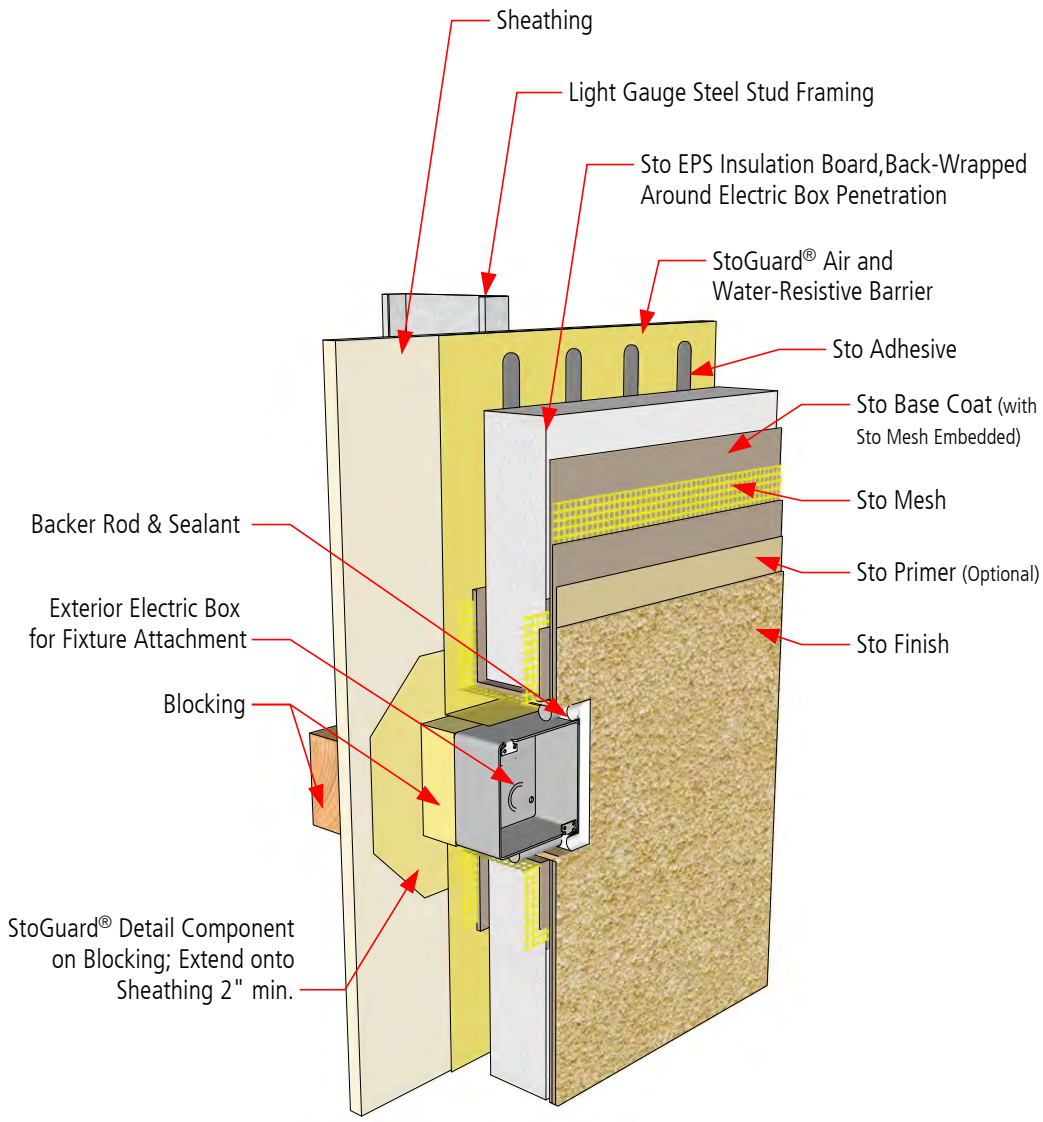
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci
Fixture Attachment

Detail No.: 52s.73
Date: June 2022



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

SECTION 07 24 19
MASONRY VENEER ENGINEERED SYSTEM (MVES)

PART 1 GENERAL

1.1 SUMMARY

A. Provide air and water-resistive barrier, and compatible EIFS with adhered masonry veneer for vertical above grade exterior walls

B. Related Sections

1. Section 03 00 00: Concrete
2. Section 04 00 00: Unit Masonry
3. Section 04 71 00: Manufactured Brick Masonry
4. Section 05 10 00: Structural Metal Framing
5. Section 06 10 00: Rough Carpentry
6. Section 06 16 00: Sheathing
7. Section 07 26 00: Vapor Retarders
8. Section 07 27 00: Air Barriers
9. Section 07 62 00: Sheet Metal Flashing and Trim
10. Section 08 10 00: Doors and Frames
11. Section 08 40 00: Entrances, Storefronts, and Curtain Walls
12. Section 09 30 00: Tiling

1.2 SUBMITTALS

A. Manufacturer's specifications, design guide and details, installation instructions, and product data

B. Manufacturer’s code compliance report

C. Manufacturer's standard warranty

D. Applicator's industry training credentials

E. Samples for approval as directed by architect or owner

F. Sealant manufacturer's certificate of compatibility

G. Prepare and submit project-specific details (when required by contract documents)

1.3 REFERENCES

A. ANSI Standards

1. 118.15, Improved Modified Dry-Set Cement Mortar
2. 118.7, High Performance Cement Grouts for Tile Installation

B. ASTM Standards

1. C150, Standard Specification for Portland Cement
2. C482, Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste
3. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
4. C920, Standard Specification for Elastomeric Joint Sealants
5. C1177, Specification for Glass Mat Gypsum for Use as Sheathing
6. C1382, Standard Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish Systems
7. D1970, Standard Specification for Self-Adhered Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
8. E84, Test Method for Surface Burning Characteristics of Building Materials
9. E96, Standard Test Methods for Water Vapor Transmission of Materials
10. E119, Method for Fire Tests of Building Construction and Materials
11. E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under specified Pressure Differences Across the Specimen
12. E330, Test Method for Structural Performance of Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
13. E331, Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
14. E2178, Test Method for Air Permeance of Building Materials
15. E2273, Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish System (EIFS) Clad Wall Assemblies
16. E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
17. E2430, Standard Specification for Expanded Polystyrene (“EPS”) Thermal Insulation Boards for Use in Exterior Insulation and Finish Systems (“EIFS”)
18. E2486, Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
19. E2568, Standard Specification for PB Exterior Insulation and Finish Systems

C. ICC-ES Acceptance Criteria, Building Codes

1. AC 235, Acceptance Criteria for EIFS Clad Drainage Wall Assemblies (July 2020)
2. AC 212, Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing
3. IBC- 2021, 2018, International Building Code
4. IRC- 2021, 2018, International Residential Code
5. IECC- 2021, 2018, International Energy Conservation Code

D. National Fire Protection Association (NFPA) Standards

1. NFPA 268, Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source
2. NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components

E. South Coast AQMD (Air Quality Management District) Standards

1. Rule 1113, Architectural Coatings

F. UL Solutions

1. UL ER16529-01, Atlas Molded Products, A Division of Atlas Roofing Corporation

G. Other Referenced Documents

1. APA Engineered Wood Association E30, Engineered Wood Construction Guide
2. ICC ESR-1233, StoGuard Air Barrier and Water-Resistive Barrier System, StoEnergy Guard (StoGuard with Continuous Insulation), and StoPanel Backup
3. ICC ESR-1748, StoTherm ci, StoTherm ci MVES, and StoTherm ci with StoCast Finishes
4. ICC ESR-4500, StoPanel Classic ci, StoPanel Impact ci, StoPanel XPS, and StoPanel Classic NExT ci and StoPanel Backup
5. StoTherm EIFS: Installation Guide
6. Sto RapidGuard®: Installation Guide
7. StoGuard® Conformable Membrane: Installation Guide
8. StoTherm ci MVES Design Guide and Detail Booklet
9. Sto Tech Hotline No. 0821-M, Quick Reference Guide on Adhered Masonry Veneers in Exterior Wall Construction

1.4 DESIGN REQUIREMENTS

Consult StoTherm ci MVES Design Guide and Detail Booklet, and the Design Guidance section in the front of this specification, for limits of system and guidance on design and design details. Coordinate this section with other material specification sections and detail drawings as applicable.

1.5 PERFORMANCE REQUIREMENTS

A. Air and Water-resistive Barrier

1. Air leakage less than 0.004 cfm/ft^2 (0.02 L/s·m^2) at 1.57 psf (75 Pa) when measured in accordance with ASTM E2178
2. Assembly air leakage less than 0.04 cfm/ft^2 (0.2 L/s·m^2) after conditioning protocol when measured in accordance with ASTM E2357
3. Vapor Permeable, Water vapor permeance greater than 10 perms when measured in accordance with ASTM E96, Method B
4. Vapor Impermeable, Water vapor permeance less than 0.1 perms when measured in accordance with ASTM E96, Method A
5. No water penetration when subjected to sequential water spray of 2.86 psf (137 Pa), then 6.24 psf (299 Pa), for 15 minutes at each pressure interval, when measured in accordance with ASTM E331
6. No water penetration at nail puncture after 72 hours at 40°F (4°C) when measured in accordance with ASTM D1970

B. EIFS with Adhered Masonry Veneer (AMV)

1. Meets or exceeds durability requirements of ASTM E2568 (modified for AMV)

2. Drainage efficiency greater than 95% when measured in accordance with ASTM E2273
3. No water penetration when subjected to 75 minutes of water spray at 6.24 psf (299 Pa) and measured in accordance with ASTM E331
4. Flame spread and smoke development of lamina (base coat, reinforcing mesh, and finish) less than 25 and 450, respectively, when tested in accordance with ASTM E84
5. Meets acceptance criteria of NFPA 285 for use on non-combustible construction
6. No ignition when exposed to radiant heat in accordance with NFPA 268
7. Maintains hourly fire resistance rating of known, rated wall assembly when tested in accordance with ASTM E119
8. Meets standard impact resistance with Sto Mesh, when measured in accordance with ASTM E2486
9. Ultimate wind load capacity of plus 220 psf, minus 166 psf (plus 10.5 kPa, minus 7.95 kPa) with thin brick, plus 160 psf, minus 107 psf (plus 7.66 KPa, minus 5.12 kPa with manufactured stone, when measured in accordance with ASTM E330, and support wall construction achieves equal or greater ultimate load capacity

1.6 COMPLIANCE

A. Air and Water-resistive Barrier

1. Meets or exceeds maximum allowable material air leakage requirements of the 2021 and 2018 IECC based on independent laboratory testing in accordance with ASTM E2178
2. Meets or exceeds maximum allowable assembly air leakage requirements of the 2021 and 2018 IECC based on independent laboratory testing in accordance with ASTM E2357
3. Meets requirements of ICC AC 212 for coatings used as WRBs over sheathing
4. Listed as compliant with 2021 and 2018 IBC, IRC, and IECC in a current ICC-ES Evaluation Report
5. Meets VOC standard of South Coast AQMD Rule 1113 for Building Envelope Coatings

B. EIFS with AMV Cladding

1. Meets ASHRAE 90.1-2019, Section 5, Building Envelope, continuous insulation requirements
2. Meets performance and weather resistance requirements of 2021 and 2018 IBC Chapter 14, complies with requirements of Chapter 26 for use on noncombustible construction (Types I, II, II, and IV) and Chin fire-resistance rated wall assemblies. Complies with requirements for use on combustible (Type V) construction.
3. Meets performance and weather resistance requirements of 2021 and 2018 IRC Chapter 7
4. Meets requirements of ICC AC 235 for EIFS clad drainage wall assembly
5. Listed as compliant with 2021 and 2018 IBC and IRC in a current ICC-ES Evaluation Report

C. Joint Sealant for Use with EIFS

1. Conforms with ASTM C920: Type S, Grade NS, Use NT, A, M, Class 100/50
2. Tested in accordance with ASTM C1382
3. Meets Federal Specification TT-S-00230C Type II

4. Conforms with AAMA 808.3 (Type1) Exterior Perimeter Sealing

1.7 QUALITY ASSURANCE

A. Manufacturer Requirements

1. Member in good standing of the EIFS Industry Members Association (EIMA) for over thirty (30) years
2. Air and water-resistive barrier and EIFS manufacturer for a minimum thirty (30) years
3. Manufacturing facilities in compliance with ISO 9001 Certified Quality System and ISO 14001 Certified Environmental Management System

B. Contractor Requirements

1. Engaged in application of similar systems for a minimum of three (3) years
2. Knowledgeable in the proper use and handling of Sto materials
3. Employ skilled mechanics who are experienced and knowledgeable in air and water-resistive barrier application, EIFS application, and ceramic tile, thin brick application, or stone thin-set method of application, and familiar with the requirements of the specified work
4. Successful completion of minimum of three (3) projects of similar size and complexity compared to the specified project
5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with Sto's published specifications and details and the project plans and specifications

C. Insulation Board Manufacturer Requirements

1. Insulation board listed by an approved agency and in compliance with the applicable building code
2. GPS board manufactured under Sto agreement
3. EPS board manufactured under Sto licensing agreement by EPS molder recognized by Sto as being capable of producing EPS insulation board to meet EIFS requirements

D. AMV Manufacturer Requirements

1. Provide AMV units in conformance with the IBC and IRC size, weight, and durability requirements.
2. Provide AMV units that comply with minimum 50 lb/in^2 (0.345 N/mm^2) shear bond strength when tested in accordance with ASTM C482.

E. Mock-ups and Testing

1. Construct full-scale mock-up of typical air and water-resistive barrier and EIFS/window wall assembly with specified tools and materials and test air leakage, water infiltration and structural performance in accordance with ASTM E283, ASTM E331 and ASTM E330, respectively, through independent laboratory. Mock-up shall comply with requirements of project specifications. Where mock-up is tested at job site maintain approved mock-up at site as reference standard. If tested off-site accurately record construction detailing and sequencing of approved mock-up for replication during construction.
2. Conduct AWRB adhesion tests in accordance with ASTM D4541 to foundation waterproofing, roofing material, and any other unknown or untested AWRB substrate connections to verify adequacy of adhesion.

3. Conduct shear bond strength tests of AMV unit in accordance with ASTM C482 to verify adequacy of adhesion.

F. Inspections

1. Provide independent third-party inspection where required by code or contract documents
2. Conduct inspections in accordance with code requirements and contract documents

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product

B. Protect coatings (pail products) from freezing and temperatures in excess of 90°F (32°C). Store away from direct sunlight

C. Protect portland cement-based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location

D. Store foam adhesive in a clean, dry area at room temperatures ranging from 50 to 75ºF (10 to 24ºC). Protect from freezing and direct sunlight. Avoid contact with water. Keep away from sources of heat, sparks, flame, ignition, and physical abuse

E. Store gun-grade air barrier component at temperatures between 40 and 80°F (4 and 26°C), and protect from freezing, moisture, direct sunlight, and keep away from sources of ignition

F. Keep products packaged in cartons off the ground in a cool dry environment

G. Insulation material is combustible. Keep away from flame or ignition sources, direct sun exposure, high heat, and temperatures in excess of 165˚F (73.8□C)

H. Store and handle all products as directed on labeling

1.9 PROJECT/SITE CONDITIONS

A. Maintain ambient and surface temperatures above 40°F (4°C) during application and drying period, minimum 24 hours after application of air and water-resistive barrier and EIFS products

B. Maintain ambient and surface temperatures between 45 and 85°F (7 and 29°C) during application and drying period of AMV adhesive – not less than 24 hours.

C. Provide supplementary heat for installation in temperatures less than 40°F (4°C) for air and water-resistive barrier and EIFS products, and less than 45°F (7°C) for AMV adhesive.

D. Provide protection of surrounding areas and adjacent surfaces from application of products

1.10 COORDINATION/SCHEDULING

A. Provide site grading such that the EIFS with adhered masonry veneer terminates above grade a minimum of 6 inches (150 mm) or as required by code

B. Provide roofing and protection at roof and floor levels to prevent excess water entry to the interior or into and behind the exterior wall during construction.

C. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuously connected air and water-resistive barrier

D. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall

E. Install window and door head flashing immediately after windows and doors are installed

F. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior

G. Install splices or tie-ins from air and water-resistive barrier over back leg of flashings, and similar details, to form a shingle lap that directs water to the exterior

H. Install copings and sealant immediately after installation of the EIFS/AMV assembly when coatings are dry, and such that, where sealant is applied against the EIFS surface, it is applied against the base coat or primed base coat surface

I. Schedule work such that the air and water-resistive barrier is exposed to weather no longer than 180 days, or 90 days when stated on manufacturer's product bulletin

J. Attach penetrations through the EIFS to structural support and provide watertight seal at penetrations

1.11 WARRANTY

A. Provide manufacturer's standard warranty

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide air and water-resistive barrier, EIFS materials, and AMV adhesive from single source

1. Sto Corp., 3800 Camp Creek Parkway, Building 1400, Suite 120, Atlanta, GA 30331
Tel: 800 221 2397, www.stocorp.com

B. Provide insulation board from Sto listed or licensed source

1. GPS Insulation Board – Atlas Molded Products, A Division of Atlas Roofing Corporation

2. EPS Insulation Board – Sto licensed EPS Board molder *(contact Sto Corp. for a list of licensed molders)*

C. Material provided by others

1. EIFS fasteners: Wind-lock, 1055 Leiscz's Bridge Road, Leesport, PA 19533, Tel: 800 872 5625

2. Adhered Masonry Veneer: ASTM C1088 compliant thin brick or ASTM C1670 (AC 51) compliant manufactured stone

3. AMV Grout/Pointing Mortar: ANSI 118.7 compliant grout produced by manufacturer with current ISO 9001 compliant quality system

2.2 AIR AND WATER-RESISTIVE BARRIER

Refer to Sto Guide Details, Sto RapidGuard Installation Guide, and StoGuard Conformable Membrane Installation Guide to assist in selecting the proper detail components

A. StoGuard Detail Components

1. Sheathing Joint Treatment, Rough Opening (RO) Protection, Counterflashing, and Penetrations:

a. Sto Gold Coat, Sto AirSeal, or StoGuard VaporSeal: brush, spray or roller applied air and water-resistive barrier coating used with StoGuard Fabric reinforcement

b. Sto RapidGuard: single component rapid drying gun-applied STPE detail component

c. Sto Gold Fill: trowel applied detail component used with StoGuard Mesh, glass fiber self-stick reinforcing mesh

d. StoGuard Conformable Membrane – self-adhered membrane flashing for use over prepared vertical above-grade concrete, concrete masonry, brick masonry, wood sheathing, glass mat gypsum sheathing, and cementitious sheathing

2. Static Joints and Seams

a. Sto RapidGuard: single component rapid drying gun-applied treatment for static joint transitions to dissimilar construction (i.e., masonry to frame wall), balcony floor slab-to-ceiling, and wall sheathing to foundation

3. Static and Dynamic Joints

a. StoGuard Conformable Membrane: self-adhered membrane flashing for use over prepared vertical above-grade concrete, concrete masonry, brick masonry, wood sheathing, glass mat gypsum sheathing, and cementitious sheathing used to:
- Seal joints and seams in wall sheathing
- Seal static joints between dissimilar materials
- Flash exterior wall openings and protect rough openings
- Seal between window flange and wall sheathing
- Connect to above grade foundation waterproofing
- Connect to roof membrane
- Seal around wall penetrations such as pipes, scuppers, vents
- Back masonry wall ties
- Seal dynamic joints in wall construction

Choose one coating and select application by Substrate (B1a, B2a, or B3), Medium Build (B1b, B2b, or B3), or High Build (B1c, B2c, or B3) as indicated

B. Air and Water-resistive Barrier Coating

1. Sto Gold Coat: ready mixed vapor permeable air and water-resistive barrier coating applied

a. By substrate as follows:
- Glass Mat Gypsum: apply one coat at minimum 10 mils WFT
- Plywood: apply one coat at minimum 10 mils WFT
- Cement Board: apply one coat at minimum 10 mils WFT
- OSB: apply one or two coats at minimum 20 mils WFT. If applied by roller, apply two coats. Touch up any bare spots and raised OSB strands.
- CMU: apply two or three coats at minimum 20-60 mils WFT.
- Concrete: apply one coat at minimum 10 mils WFT

b. To achieve Medium-Build apply in one or two coats at minimum 20 mils WFT. If applied by roller apply two coats to achieve minimum 20 mils WFT. For CMU substrates apply two or three coats to achieve 20-60 mils WFT.

c. To achieve High-Build apply in two or three coats at minimum 40 mils WFT. If applied by roller apply three or more coats as needed. For CMU substrates apply multiple coats to achieve 40-60 mils WFT.

2. Sto AirSeal: ready mixed vapor permeable air and water-resistive barrier coating applied

a. By substrate as follows:
- Glass Mat Gypsum: apply one coat at minimum 20 mils WFT

- Plywood: apply one coat at minimum 20 mils WFT
- Cement Board: apply one coat at minimum 20 mils WFT
- OSB: apply one or two coats at minimum 20 mils WFT. If applied by roller, apply two coats. Touch up any bare spots and raised OSB strands.
- CMU: apply two or three coats at minimum 20-65 mils WFT.
- Concrete: apply one coat at minimum 20 mils WFT

b. To achieve Medium-Build apply in one or two coats at minimum 40 mils WFT. If applied by roller apply two coats to achieve minimum 40 mils WFT. For CMU substrates apply two or three coats to achieve 40-65 mils WFT.

c. To achieve High-Build apply in one, two or three coats at minimum 65 mils WFT. If applied by roller apply minimum three coats to achieve minimum 65 mils WFT.

3. StoGuard VaporSeal: Class 1 vapor retarder coating for use over prepared vertical above-grade concrete, concrete masonry, brick masonry, wood sheathing, cementitious sheathing, and glass mat gypsum sheathing, applied by airless spray in one or two coats to achieve minimum 80 mils total WFT

Refer to Tables in Appendix for product names and combinations of products based on compliance with the 2021 and 2018 IBC and 2021 and 2018 IRC and select one in each category: Insulation Adhesive, Insulation Board, Base Coat, Reinforcing Meshes, Primer, and Finish. Consult Sto for any additional guidance on product selection.

2.3 INSULATION ADHESIVE *(refer to Tables in Appendix for guidance on product selection)*

A. Sto one component polyurethane foam adhesive

1. Sto TurboStick®

2.4 INSULATION BOARD

Select one product based on the options presented below, regulatory requirements, R-value, and other applicable criteria.

A. Graphite Enhanced Polystyrene Insulation Board

1. Sto GPS Board: nominal 1.0 lb/ft3 (16 kg/m3) graphite enhanced polystyrene rigid foam plastic insulation board in compliance with ASTM E2430 and ASTM C578 Type I requirements, R-4.7 per inch (RSI – 0.83 per 25mm), listed, labelled, and furnished in accordance with Section 1.7C.

B. Expanded Polystyrene Insulation Board

1. Sto EPS Insulation Board: nominal 1.0 lb/ft^3 (16 kg/m^3) Expanded Polystyrene (EPS) rigid foam plastic insulation board in compliance with ASTM E2430 and ASTM C578 Type I requirements, R-3.6 per inch (RSI – 0.63 per 25mm), listed, and furnished in accordance with Section 1.7C.

2.5 BASE COAT

A. Cementitious Base Coat

1. Sto Primer/Adhesive – acrylic admixture for use with Type 1 portland cement

2.6 REINFORCING MESHES

A. Standard Mesh

1. Sto Mesh 6 oz – nominal 6 oz/yd^2 (203 g/m^2), symmetrical, interlaced open-weave glass fiber fabric made with alkaline resistant coating for compatibility with Sto materials

B. Specialty Meshes

1. Sto Detail Mesh – nominal 4.2 oz/yd^2 (143 g/m^2), flexible, symmetrical, interlaced glass fiber fabric, with alkaline resistant coating for compatibility with Sto materials *(used for standard back wrapping of insulation boards)*

2.7 AMV ADHESIVE

A. StoColl – polymer modified portland cement adhesive mortar for AMV in compliance with ANSI118.15

2.8 AMV GROUT / POINTING MORTAR

A. Polymer modified portland cement grout in conformance with ANSI 118.7

2.9 JOB MIXED INGREDIENTS

A. Water – clean and potable

B. Type I portland cement in compliance with ASTM C150

2.10 ACCESSORIES

A. Fasteners – Wind-lock corrosion resistant fastener with 1-1/4 inch (32mm) diameter galvanized steel lath-plate (legless) washer. Fastener type and length must be sufficient for minimum 3 thread penetration into steel studs and minimum 1 inch (25mm) penetration into concrete or CMU construction

B. StoSeal® STPE Sealant - high-movement, low modulus, non-sag one-component silyl-terminated polyether joint sealant in compliance with ASTM C920 and tested in accordance with ASTM C1382

2.11 MIXING

A. Refer to manufacturer's applicable product bulletins for mixing of materials

PART 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Prequalify under Quality Assurance requirements of this specification (Section 1.7B)

3.2 EXAMINATION

A. Inspect concrete and masonry substrates prior to start of application for:

1. Contamination—algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew, or other foreign substances
2. Surface absorption
3. Cracks—measure crack width and record location of cracks
4. Damage and deterioration such as voids, honeycombs and spalls
5. Moisture content and moisture damage—use a moisture meter to determine if the surface is dry enough to receive the products and record any areas of moisture damage
6. Compliance with specification tolerances—record areas that are out of tolerance (greater than ¼ inch in 10 feet [6mm in 3 m] deviation in plane)

B. Inspect sheathing application for compliance with applicable requirement and installation in conformance with specification and manufacturer requirements:

1. Glass Mat Faced gypsum sheathing compliant with ASTM C1177 – consult manufacturer
2. Exterior Grade and Exposure I wood based sheathing – APA Engineered Wood Association E30
3. Cementitious sheathing – consult manufacturer
4. Attachment into structural supports with adjoining sheets abutted (gapped if wood-based sheathing) and fasteners at required spacing to resist design wind pressures as determined by design professional
5. Fasteners seated flush with sheathing surface and not over-driven

C. Report deviations from the requirements of project specifications or other conditions that might adversely affect the air and water-resistive barrier, EIFS, or AMV installation to the General Contractor. Do not start work until deviations are corrected.

3.3 SURFACE PREPARATION

A. Remove surface contaminants on concrete, concrete masonry, gypsum sheathing, or coated gypsum sheathing surfaces

B. Repair cracks, spalls or damage in concrete and concrete masonry surfaces, and level concrete and masonry surfaces to comply with required tolerances

C. Apply conditioner (consult Sto) by spray or roller to chalking or excessively absorptive surfaces or pressure wash to remove surface chalkiness

D. Remove fasteners that are not anchored into supporting construction and seal holes with air and water-resistive barrier detail material

E. Seal over-driven fasteners with Sto air and water-resistive barrier detail material and install additional fasteners as needed to comply with fastener spacing requirement

F. Fill large gaps between sheathing or voids around pipe, conduit, scupper, and similar penetrations with spray foam and shave flush with surface (refer to Sto Details)

G. Replace weather-damaged sheathing and repair or replace damaged or cracked sheathing

3.4 INSTALLATION

A. Install manufacturer's air and water-resistive barrier in conformance with manufacturer's written instructions (*refer to applicable Sto product bulletins and StoTherm ci MVES Design Guide and Detail Booklets*)

B. Install manufacturer's EIFS cladding in conformance with manufacturer's written instructions (*refer to product bulletins, StoTherm EIFS: Installation Guide, and StoTherm ci MVES Design Guide and Detail Booklets*)

C. Install AMV in conformance with AMV adhesive manufacturer's written instructions *(refer to 81789 StoColl Adhesive Mortar Product Bulletin)*

D. Install AMV grout/pointing mortar in conformance with grout manufacturer's written instructions

3.5 PROTECTION

A. Provide protection of installed materials from water infiltration into or behind them

B. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry

3.6 CLEANING, REPAIR AND MAINTENANCE

A. Clean and maintain the EIFS/AMV assembly for a fresh appearance and to prevent water entry into and behind the system. Repair cracks, impact damage, spalls or delamination promptly.

B. Maintain adjacent components of construction such as sealants, windows, doors, and flashing, to prevent water entry into or behind the EIFS/AMV assembly and anywhere into the wall assembly.

Appendix: StoTherm ci MVES Cladding Components

IMPORTANT: Listing of Sto GPS Board with ICC-ES is pending in ICC ESR-1748

Table 1. StoTherm ci MVES Cladding Components

Adhesive	Continuous Insulation[1,2,3,4]	Base Coats	Reinforcing Mesh	Finish
Sto TurboStick Sto TurboStick Mini	Sto GPS Board Sto EPS Insulation Board	Sto Primer/Adhesive	Sto Mesh 6oz	ASTM C1088 Thin Brick or ASTM C1670 (AC 51) Compliant Manufactured Stone adhered with StoColl Adhesive Mortar and grouted per Sto specification

1. Minimum insulation board thickness: 1 inch (25 mm). Maximum insulation board thickness: 4 inches (102mm), subject to restrictions based on fire tests (see below).
2. Use on noncombustible construction (Types I, II, III, and IV): maximum 4-in (102mm) Sto GPS Board or Sto EPS Insulation Board
3. Use on fire-resistance-rated wall construction: can be installed on 1-hour load bearing or non-load bearing fire-resistance-rated wall construction over steel frame, concrete, and concrete masonry with maximum 4-in (102mm) insulation board.
4. Use on combustible construction (Type V): maximum thickness of 4-in (102mm).

NOTE: Certain assemblies may be extended beyond the listed products and/or limitations, through engineering judgments on file at Sto Corp., or by way of modeling or rational analysis applied to the particular assembly in question.

END OF SECTION

Building with conscience.

StoTherm® ci MVES

Design Guide and Detail Booklet
Series 57s.xx | April 2024

Facades

StoTherm® ci MVES is a lightweight, energy efficient exterior wall system with Adhered Masonry Veneer – thin brick, natural stone, ceramic tile, or cultured stone - that incorporates continuous insulation and a continuous air and water resistive barrier.

The Masonry Veneer Engineered System (MVES) integrates seamlessly with other Sto finishes and cladding materials.

Design Guide

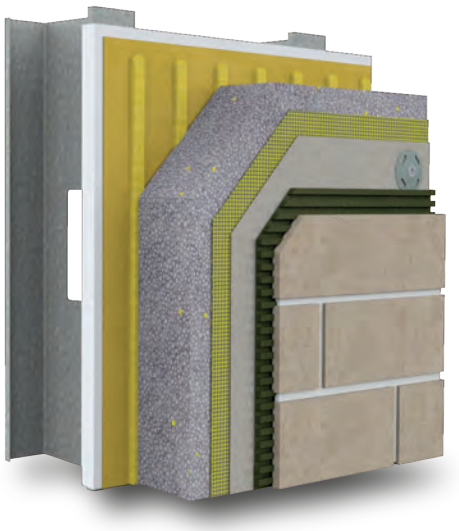
Table of Contents

System Overview 3
System Components 3
Assembly Diagram 6
General Notes 6
StoGuard Product Use Chart 11
Additional Information 12
Guide Details 13

ATTENTION

The final design of any project is the sole responsibility of the Design Professional, with considerations for compliance of local building and design codes and requirements. Sto Corp. accepts no liability for design, engineering, or workmanship of any project. The information provided herein is in addition to other technical data provided by Sto Corp. (System Bulletin, Specification, Guide Details, etc). For more information, please visit www.stocorp.com

Sto Corp.
3800 Camp Creek Pkwy. SW
Bldg. 1400 • Suite 120
Atlanta, GA 30331
Tel: (800) 221-2397
Fax: (404) 346-3119
http://www.stocorp.com
helpdesk.stocorp.com



StoTherm®ci MVES

StoTherm®ci MVES (Masonry Veneer Engineered System) is an exterior insulated wall cladding with adhered masonry veneer and is intended for use on vertical above grade exterior walls. It incorporates an air and water-resistive barrier (AWRB) and continuous exterior insulation attached with vertical ribbons of adhesive to the AWRB, which forms a drainage cavity. A glass fiber mesh reinforced base coat is installed over the continuous insulation, which serves as a base to attach thin brick, thin natural stone, ceramic tile, or manufactured stone with Sto high performance masonry veneer adhesive. The system combines seamlessly with other Sto decorative and protective architectural finishes on a single substrate to facilitate design and installation detailing.

NOTE: Sto documents referenced in this booklet are in **bold** and can be viewed or downloaded by visiting the documentation center at www.stocorp.com, where other information - Guide Specification, System Bulletin, and Product Bulletins – is also available.

Fluid-Applied Membranes

Sto Gold Coat® - Spray or roller applied vapor-permeable air and water-resistive barrier for use behind most claddings and as part of StoTherm®ci, StoPowerwall®, StoQuik® and StoVentec® systems.

Sto Gold Coat® TA - Trowel applied vapor-permeable air and water-resistive barrier for use with StoTherrm®ci, StoPowerwall® and StoQuik® systems.

Sto AirSeal® - Spray or roller applied vapor-permeable air and water-resistive barrier for use behind most claddings and as part of StoTherm®ci, StoPowerwall®, StoQuik® and StoVentec® systems.

StoGuard VaporSeal® - Spray or roller applied Class 1 vapor retarder. Also functions as an air and water-resistive barrier for use behind most claddings and as part of StoTherm®ci, StoPowerwall®, StoQuik® and StoVentec® systems.

Detail Component Products

Sto RapidGuard® - One component air barrier and waterproof material used to protect rough openings, sheathing joints, seams, cracks, penetrations, and other transitions in above grade wall construction.

StoGuard® Conformable Membrane - A versatile, easy to install membrane that simplifies detailing of transitions for air barrier continuity in Sto proprietary wall systems and other wall assemblies.

StoGuard® Fabric - Non-woven cloth reinforcement used to treat sheathing joints and rough openings when embedded in Sto Gold Coat®, Sto AirSeal® or StoGuard® VaporSeal.

Continued on next page

Detail Component Products (cont'd)

StoGuard® RediCorner - A preformed StoGuard® fabric piece used in the corners of rough openings for quicker installation.

Sto Gold Fill® - Trowel applied compound used with StoGuard® Mesh or StoGuard® Detail Mesh to treat rough openings and sheathing joints.

StoGuard® Mesh - Self-adhesive, glass fiber reinforcement used with Sto Gold Fill and Sto Gold Coat TA as part of the StoGuard® assembly.

Sto Detail Mesh - Glass fiber reinforcement mesh used with Sto Gold Fill and Sto Gold Coat TA.

StoGuard® Transition Membrane - Flexible air barrier material used to make connections with adjoining construction and dissimilar materials, and to bridge dynamic joints.

Adhesives and Insulation

Sto TurboStick® - is a ready-to-use, single component polyurethane foam adhesive used for securing insulation panels to the substrate and filling seams and gaps in insulation board surface.

StoColl - polymer modified portland cement adhesive mortar for installing Adhered Masonry Veneer (AMV) - thin brick, thin stone, ceramic tile, and manufactured stone.

Sto GPS Board: Graphite enhanched polystyrene insulation (GPS) board for higher R-value per thickness, in conformance with ASTM E2430 and ASTM C578, Type I.

Sto EPS Insulation Board: Expanded polystyrene insulation (EPS) board in compliance with ASTM E2430 and ASTM C578, Type I.

Base Coats

Sto Primer/Adhesive - A two-component polymer modified, trowel applied base coat consisting of an acrylic admixture mixed with Type I portland cement.

Primers

StoPrime® Sand - A roller, brush or sprayed applied, tintable, sanded primer used to reduce surface water absorption of the base coat, and to enhance finish color, texture, and coverage of finishes.

StoPrime® - A roller, brush or sprayed applied, tintable, used to reduce surface water absorption of the base coat, and to enhance finish color, texture, and coverage of finishes.

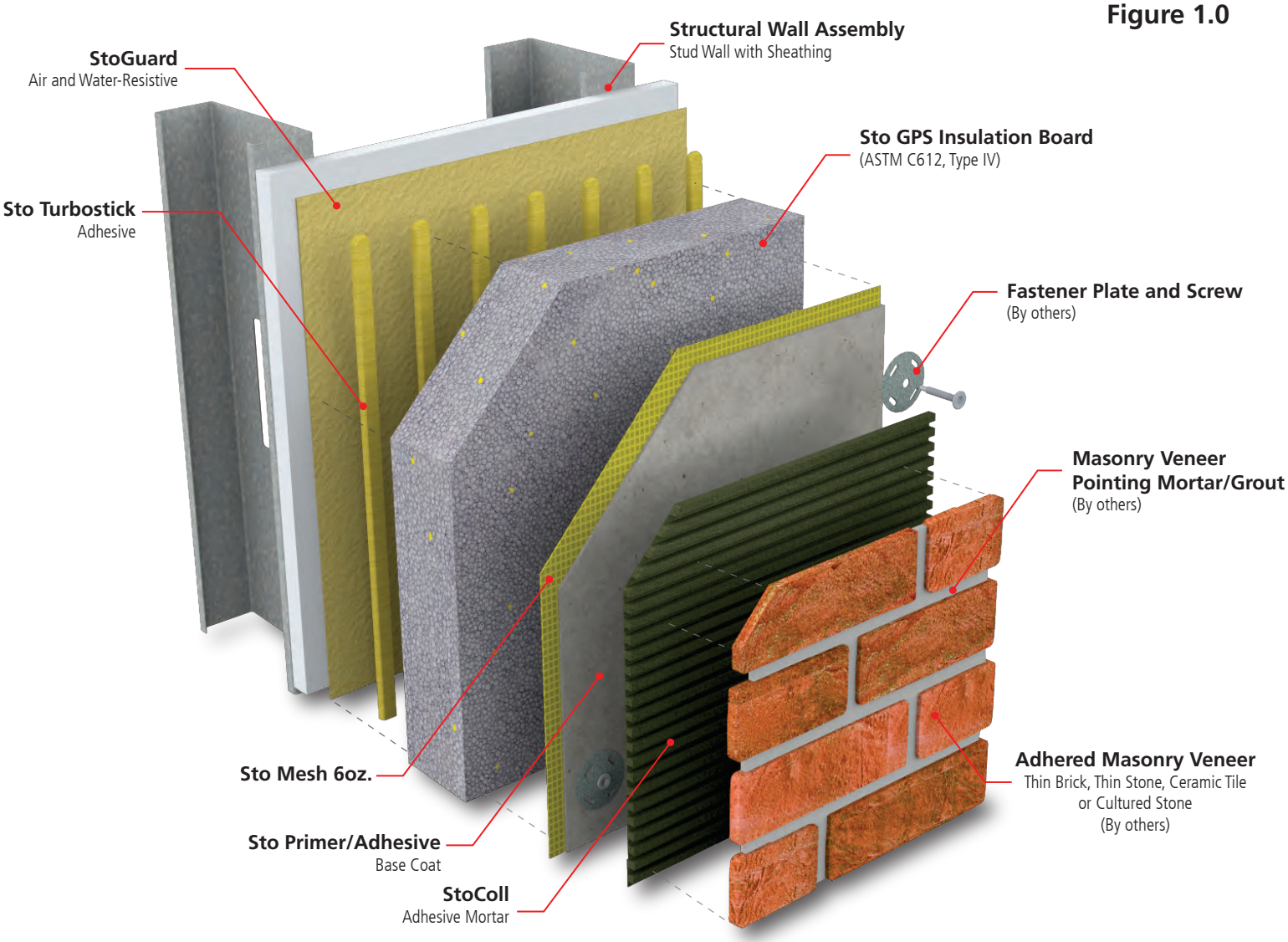
StoPrime® UV - A roller, brush or sprayed applied primer used for prepared concrete, masonry, plaster, EIFS base coat, or drywall surfaces prior to application of Sto Finishes and Coatings

Finishes

Masonry Veneer Pointing Mortar/Grout - Joint filler, polymer modified portland cement pointing mortar or grout in conformance with ANSI 118.7. (furnished by others).

Adhered Masonry Veneer - Masonry veneer wall cladding: thin brick, thin stone, ceramic tile, or cultured stone, in conformance with applicable building code requirements (furnished by others).

Figure 1.0



Structural Considerations

1. StoTherm®ci MVES is a non-structural exterior wall cladding. It is non-load bearing and does not provide racking resistance, nor is it to be used as a base for mechanical anchoring of attachments such as signage or light fixtures. The structural backup wall, typically concrete, concrete masonry, or a frame wall with sheathing, must be designed and built for these purposes in accordance with the applicable building code.

2. Wind Loads: Design deflection criteria for StoTherm ci® MVES is L/360. StoTherm®ci MVES transfers positive wind loads to the supporting wall construction and resists negative wind loads via adhesive attachment to a substrate.

Frame Wall Construction: The system requires minimum 2x4 wood studs or minimum 18 gage steel studs with maximum stud spacing of 16 inches (406mm) on center.

Generally, StoTherm®ci MVES is not the determinant of ultimate wind load capacity on frame walls. The supporting frame wall construction, or sheathing attachment, typically dictates ultimate load capacity of the assembly. Consult ICC ESR-1748 for allowable wind loads (published values have a safety factor of 3 applied to ultimate loads). In some cases, such as painted wall substrates, where adhesion may not be possible, full mechanical attachment is necessary. Refer to ICC ESR-1030 for information on allowable wind loads of mechanically attached StoTherm® ci systems.

Continued on next page

Fire Protection

StoTherm®ci MVES uses combustible foam plastic insulation as its insulating component. Use of foam plastics on exterior walls is covered in Chapter 26 of the IBC (International Building Code), which requires certain tests to allow use of foam plastics on noncombustible construction. Based on testing and evaluation of StoTherm ci MVES in accordance with NFPA 285 and NFPA 268 (and other fire tests and criteria listed in the code), the system complies with requirements for use on noncombustible construction (Types I, II, III, and IV). The system may also be used on combustible (Type V) construction.

Where a fire resistance rating is required, in general, StoTherm®ci MVES does not add to nor detract from the rating of an hourly rated load bearing or non-load bearing concrete, concrete masonry, or steel frame base wall assembly, based on testing in accordance with ASTM E119.

Refer to ICC ESR-1748 for more information on tested assemblies. Note that certain assemblies may be extended beyond the recognition provided in the ICC evaluation report through engineering judgments on file at Sto Corp., or by way of modeling or rational analysis applied to the particular product or assembly in question.

Moisture Protection

General: StoTherm®ci MVES has redundant built-in moisture protection with StoGuard®, the air and water-resistive barrier component in the assembly. StoGuard® is applied to the structural backup wall and protects against water damage from rain during construction when the building is "closed-in," and in the event of a breach in the wall cladding while in service. StoGuard® is available as a vapor permeable or vapor impermeable fluid-applied membrane.

The system also has built-in drainage capability. When properly combined with flashing, the system effectively drains water, based on testing in accordance with ASTM E2273.

StoGuard® is not intended to correct faulty design or workmanship, such as the absence or improper integration of flashing, roofing, copings, and sealants in the construction, which shed water and prevent water entry into wall construction. StoGuard® is not intended to correct defective components of construction such as windows that leak into the wall assembly. Basic principles that should be followed in the design, detailing, and construction of the wall assembly include:

1. Flashing: Provide flashing to direct water to the exterior where it is likely to penetrate components in the wall assembly, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, abutments of lower walls with higher walls, above projecting features, at floor lines, and at the base of the wall.

2. Air Leakage Prevention: Provide continuity of the air barrier assembly at foundation, roof, windows, doors, and other penetrations through the wall with connecting and compatible air barrier components, to minimize condensation caused by air movement. In most cases StoGuard® Detail Components will facilitate detailing at these transitions. Take into account construction sequencing when designing an airtight assembly and the effects of airtightness on mechanical ventilation in the overall project design.

3. Water Vapor Diffusion: Perform a dew point analysis and/or dynamic hygrothermal modeling of the wall assembly to determine the potential for accumulation of moisture by diffusion of water vapor. Adjust insulation thickness and/or other wall assembly components accordingly to eliminate or minimize the risk of a dew point in the wall assembly. Avoid the use of vapor retarders on the interior side of the wall in hot, humid climates.

Continued on next page

Moisture Protection (cont'd)

4. Terminations and Sealants: Provide minimum 1/2 inch (13 mm) wide perimeter sealant joints at all penetrations through StoTherm®ci MVES (windows, doors, scuppers, mechanical, electrical, and plumbing penetrations, etc.).

   Size joints at terminations based on anticipated movement and specify sealant and backer rod that is compatible with StoTherm® ci MVES, supported by the sealant manufacturer's certificate of compatibility. Typically, sealant is adhered to the StoTherm®ci MVES reinforced base coat or primed base coat, or to the masonry veneer unit.

   Arrange for field adhesion testing to verify adhesion compatibility and obtain the sealant manufacturer's adhesion data to the sealant substrate(s).

   Maintain air barrier continuity across joints. Drain joints to the exterior or provide other means to prevent or control water infiltration at joints.

5. Grade Condition: Provide minimum 6-inch (152mm) clearance above grade or as required by code. Do not specify StoTherm® ci MVES for use below grade.

6. Testing: Conduct mock-up testing of the opaque wall-to-window assembly and other critical construction details to verify performance – air leakage resistance (ASTM E283), resistance to wind-driven rain (ASTM E331), and wind load resistance (ASTM E330).

   Do not use StoTherm®ci MVES on surfaces subject to continuous or intermittent water immersion or hydrostatic pressure. Prevent the accumulation of water behind StoTherm ci MVES, either by condensation or water leakage into the wall construction, in the design and detailing of the wall assembly, and with proper sequencing and protective measures during construction.

   For further information see **Sto Tech Hotline No. 0403-BSc, Critical Detail Checklist for Wall Assemblies, Sto Tech Hotline No. 0603-BSc, Moisture Control Principles for Design and Construction of Wall Assemblies,** and **Sto Tech Hotline No. 1001-BSc, Effects of Temporary Heating on Construction Materials in Cold Weather.**

Impact Resistance

The adhered masonry veneer provides resistance to impacts from blunt and sharp objects and is often specified for use at ground floors, areas with high pedestrian traffic, and other areas that are susceptible to damage from impacts.

StoTherm®ci MVES meets FBC (Florida Building Code) and Miami-Dade County test protocols for large and small missile impact resistance.

Acoustics

Acoustical controls are achieved primarily in the base wall assembly, for example, in frame wall construction through the use of batt insulation in the stud wall cavity, gypsum sheathing, and wood or metal stud configuration. Refer to the Gypsum Association Fire Resistance and Sound Control Design Manual for technical data on performance of base wall assemblies.

Continued on next page

Aesthetics

A wide variety of aesthetic choices exist with thin brick, thin natural stone, ceramic tile, and manufactured stone that integrate seamlessly with Sto architectural finishes. Dark colored veneer units [LRV (Light Reflectance Value) less than 20] are not recommended unless reviewed by the design professional with regard to service temperature limitations of the foam plastic insulation [(limited to a maximum service temperature of 165°F (74.8°C)] and anticipated in-service temperatures on the facade.

Do not use StoTherm®ci MVES on top of parapets or on large weather exposed projecting ledges, sills, or other projecting features unless supported by framing or other structural support and protected with metal coping or flashing.

Adhered masonry veneer units are limited in thickness, size and weight by the IBC (International Building Code) and IRC (International Residential Code). For example, maximum allowable weight is 15 lb/ft2 (73.2 kg/m2). Maximum size is not to exceed 24 inches (610mm) in any face dimension and total area of the face dimension is not to exceed 3 ft2 (0.28m2). Refer to **Sto Tech Hotline No. 0821-M, Quick Reference Guide on Adhered Masonry Veneers in Exterior Wall Construction**, for additional information.

Joints

Joints are required at:

· Joints in the supporting wall construction such as expansion joints, control joints, and cold joints

· Perimeters of windows, doors, scuppers, fixture attachments, and similar objects in the wall construction

· Changes in substrate or support construction (e.g., masonry to frame wall) or other junctures with dissimilar construction

· Floor lines in multi-story wood frame wall construction

· Floor line deflection joints

· Changes in building height and other areas of stress concentration

· Areas of not greater than 144 ft2 (13.4m^2) with length or height not exceeding 12 ft (3.6m) for ceramic tile, and not more than 18 ft (5.5m) for brick or stone, and with length/height or height/length ratio not greater than 2-1/2 to 1. Note: dark colored veneer units may require closer spacing due to increased thermal movement.

Do not bridge expansion joints, control joints, or cold joints in wall construction with StoTherm ci MVES.

Mortar Joints in adhered masonry veneer: must be grouted / pointed with grouting mortar in compliance with ANSI 118.7, except where open joints are permitted for manufactured stone. Refer to **Sto Tech Hotline No. 0821-M, Quick Reference Guide on Adhered Masonry Veneers in Exterior Wall Construction**. Note: grout is furnished by others.

Regulatory Compliance

The StoTherm®ci MVES System complies with the weather resistance requirements of the 2018 IBC Sections 1407.2 and 1407.4 and complies with requirements of Chapter 26 for use on noncombustible construction (Types I, II, II, and IV), and in fire-resistance rated wall assemblies. The system also complies with ASHRAE 90.1-2019 Section 5, Building Envelope, air barrier and continuous insulation requirements.

Continued on next page

Regulatory Compliance

StoGuard® complies with IBC (International Building Code), IRC (International Residential Code), and IECC (International Energy Conservation Code) requirements as an air barrier material and water-resistive barrier (WRB). It meets requirements as an air barrier material based on testing in accordance with ASTM E2178 and as an air barrier assembly based on testing in accordance with ASTM E2357. Refer to ICC ESR-1233.

The adhered masonry veneer mortar component of the system complies with the shear bond strength requirements of IBC Section 1404.10 (as explained in Section 12.3 of TMS 402, The Masonry Society, Building Code Requirements and Specifications for Masonry Structures).

All Sto architectural coatings, textured and specialty finishes, primers, sealers, waterproofers, and underlayments comply with South Coast Air Quality Management District (South Coast AQMD) volatile organic compound (VOC) requirements.

Masonry veneer units are supplied by others and must be in compliance with applicable regulatory requirements (ASTM C1088 for thin brick, ICC AC 51 for manufactured stone, ASTM C1242 for natural stone, and ANSI 137.1 for ceramic tile), while being certified for exterior use by the manufacturer and for the climate zone in which they are intended to be used. Refer to **Sto Tech Hotline No. 0821-M, Quick Reference Guide on Adhered Masonry Veneers in Exterior Wall Construction**, for more information.

Thermal Insulation

StoTherm®ci MVES uses graphite enhanced expanded polystyrene (GPS) or expanded polystyrene (EPS) insulation board as the thermal insulating component. The insulation board is applied adhesively to StoGuard on a supporting substrate to create a continuous exterior insulating thermal barrier. Thickness is limited based on structural considerations and fire testing.

One of two types of insulation board can be used:

1. Sto GPS Board in conformance with ASTM E2430 and ASTM C578 Type I requirements. R-value is R-4.7 F•ft^2•h/Btu per inch thickness at 75°F (RSI-0.83 K•m^2/W per 25mm at 24°C). Minimum thickness is 1-1/16 inch (27mm). Maximum thickness is 12 inches (305mm). If walls are required to have an hourly fire-resistance rating, maximum thickness is 4 inches (102mm).

2. Sto EPS Insulation Board in conformance with ASTM E2430 and ASTM C578 Type I requirements. R-value is 3.6 F•ft^2•h/Btu per inch thickness at 75°F (RSI-0.634 K•m^2/W per 25mm at 24°C). Minimum thickness is 1 inch (25mm) and maximum thickness is 12 inches (305mm). If walls are required to have an hourly fire-resistance rating, maximum thickness is 4 inches (102mm).

Refer to ICC ESR-1748 for additional information and verification of building code compliance.

Insulation material is flammable and must be kept away from flame, ignition sources, high heat and temperatures in excess of 165°F [74.8° C]).

Sustainability

StoTherm® ci MVES has high potential for LEED and other sustainability program credits based on efficient and effective use of a continuous air barrier, continuous exterior insulation, and the resulting energy savings and reductions in greenhouse gas emissions. The system also has positive impacts on life cycle energy use based on reduced dead load, which permits the use of lighter gage metal studs, and supporting structural members and foundation footings, when compared to full thickness/weight masonry veneer units. The use of light gage metal framing with recycled content and StoPanel prefabricated wall construction offers additional means to obtain credits. Refer to StoPanel Technology information and ICC ESR-4500.

Accessories

1. Fasteners (by others) – Wind-lock corrosion resistant fastener with 1-1/4 inch (32mm) diameter galvanized steel lath-plate (legless) washer. Fastener type and length must be sufficient for minimum 3 thread penetration into steel studs and minimum 1 inch (25mm) penetration into concrete or CMU wall construction. Fasteners are not required at ground floors up to a height of 10ft (3m) above grade.

2. StoSeal STPE Sealant, a high-movement, low modulus, non-sag one-component silyl-terminated polyether joint sealant in compliance with ASTM C920 and tested in accordance with ASTM C1382.

Table 1.1 - StoGuard® Air & Water-Resistive Barrier Product Applications

StoGuard® Detail Component	Sheathing Joints and Corners	Flashing and Rough Opening Protection	Penetrations	Static Joints and Seams	Dynamic Joints
Sto RapidGuard®	✓	✓	✓	✓	
StoGuard® Conformable Membrane	✓	✓	✓	✓	✓
StoGuard® Fluid Applied Air & Water-Resistive Barrier with StoGuard® Fabric	✓	✓	✓		
StoGuard® Transition Membrane embedded with any StoGuard® Fluid Applied Air & Water-Resistive Barrier				✓	✓
Sto Gold Fill with StoGuard® Mesh (or Sto Detail Mesh embedded)	✓	✓	✓		
Sto Gold Coat® TA with StoGuard® Mesh	✓	✓	✓		

[1] StoGuard® Fluid Applied Air & Water-Resistive Barriers: Sto AirSeal®, Sto Gold Coat®, Sto Gold Coat®TA, StoGuard®VaporSeal®

Additional Information

Refer to Sto product bulletins, guide specifications and guide details, technical hotlines, ICC Evaluation Reports, and other sources of information available at www.stocorp.com for more details on specific Sto products, features, benefits, and limitations that apply to StoTherm® ci wall systems and components.

References:

1. American Society of Testing and Materials International (ASTM), Standard Specification for Rigid Cellular Polystyrene Thermal Insulation, ASTM C578.

2. American Society of Testing and Materials International (ASTM), Standard Specification for Thin Brick Veneer Units Made from Clay or Shale, ASTM C1088.

3. American Society of Testing and Materials International (ASTM), Standard Guide for Selection, Design, and Installation of Dimension Stone Attachment Systems, ASTM C1242.

4. American Society of Testing and Materials International (ASTM), Standard Test Methods for Fire Tests of Building Construction and Materials, ASTM E119.

5. American Society of Testing and Materials International (ASTM), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen, ASTM E283.

6. American Society of Testing and Materials International (ASTM), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference, ASTM E330.

7. American Society of Testing and Materials International (ASTM), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference, ASTM E331.

8. American Society of Testing and Materials International (ASTM), Standard Test Method for Determining Rate of Air Leakage Rate and Calculation of Air Permeance of Building Materials, ASTM E2178.

9. American Society of Testing and Materials International (ASTM), Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish System (EIFS) Clad Wall Assemblies, ASTM E2273.

10. American Society of Testing and Materials International (ASTM), Standard Specification for Expanded Polystyrene ("EPS") Thermal Insulation Boards for Use in Exterior Insulation and Finish Systems ("EIFS"), ASTM E2430.

11. American Society of Testing and Materials International (ASTM), Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies, ASTM E2357.

12. American Society of Refrigeration and Air Conditioning Engineers (ASHRAE), Energy Efficiency Standard for Buildings Except Low-Rise Residential Buildings, ANSI/ASHRAE/IES Standard 90.1-2019.

13. American National Standards Institute, High Performance Cement Grouts for Tile Installation, ANSI 118.7

14. American National Standards Institute, Standard Specification for Ceramic Tile, ANSI 137.1.

15. Gypsum Association, Fire Resistance and Sound Control Design Manual, GA-600-2021.

16. International Code Council Evaluation Service, Acceptance Criteria for Adhered Manufactured Stone Masonry Veneer, AC 51, 2018.

17. International Code Council Evaluation Service, Sto Rainscreen and Sto Rainscreen II Class PB Exterior Insulation and Finish Systems with Drainage, ICC ESR-1030.

18. International Code Council Evaluation Service, StoGuard with Sto Gold Coat, StoGuard with Sto EmeraldCoat, and StoGuard VaporSeal Air Barriers and Water-resistive Barriers, and StoEnergy Guard (StoGuard with Continuous Insulation), ICC ESR-1233.

19. International Code Council Evaluation Service, StoTherm ci, StoTherm ci MVES, and StoTherm ci with StoCast Finishes, ICC ESR-1748.

20. International Code Council Evaluation Service, StoPanel Classic ci, StoPanel Impact ci, StoPanel XPS, StoPanel Classic NExT ci, and StoPanel Backup, ICC ESR-4500.

21. International Code Council, Inc., 2018 International Building Code (IBC).

22. International Code Council, Inc., 2018 International Energy Conservation Code (IECC).

23. International Code Council, Inc., 2018 International Residential Code (IRC).

24. The Masonry Society, Building Code Requirements and Specification for Masonry Structures, TMS 402/602-16, 2016.

25. National Fire Protection Association (NFPA), Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source, NFPA 268.

26. National Fire Protection Association (NFPA), Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components, NFPA 285.

27. Sto Corp., Critical Detail Checklist for Wall Assemblies, TH-0403-BSc.

28. Sto Corp., Moisture Control Principles for Design and Construction of Wall Assemblies, TH-0603-BSc.

29. Sto Corp., Quick Reference Guide on Adhered Masonry Veneer in Exterior Wall Construction, TH-0821-M.

Sto Corp. Effects of Temporary Heating on Construction Materials in Cold Weather, TH-1001-BSc.

Design Details

Components

System Components 57s.00

Installation at Grade

Termination at Grade - Sheathing Flush with Foundation or Slab Edge 57s.03A
Termination at Grade - Sheathing Overlapping Slab or Foundation 57s.03B

Installation at Windows

Receptor-Type Window Sill - Step 1 ..... 57s.23A-1
Receptor-Type Window Sill - Step 2 ..... 57s.23A-2
Receptor-Type Window Sill - Step 3 ..... 57s.23A-3
Receptor-Type Window Head - Step 1 ..... 57s.23B-1
Receptor-Type Window Head - Step 2 ..... 57s.23B-2
Receptor-Type Window Head - Step 3 ..... 57s.23B-3
Flanged Window-Sill - Step 1 ..... 57s.24A-1
Flanged Window-Sill - Step 2 ..... 57s.24A-2
Flanged Window-Sill - Step 3 ..... 57s.24A-3
Flanged Window-Head - Step 1 ..... 57s.24B-1
Flanged Window-Head - Step 2 ..... 57s.24B-2
Flanged Window-Head - Step 3 ..... 57s.24B-3

Installation at Soffit

Insulated and Unvented 57s.30
Insulated and Unvented with StoCast Wood ..... 57s.30 SCW
Uninsulated and Vented 57s.31
Uninsulated and Vented with StoCast Wood ..... 57s.31 SCW

Installation at Floor Line

Floor Line Without Deflection 57s.40
Floor Line With Deflection - Concealed Flashing and Drainage at Floor Line 57s.41A
Floor Line With Deflection - No Drainage at Floor Line 57s.41B
Floor Line With Deflection - Flashing and Drainage at Floor Line 57s.41C

Installation at Balcony Ceiling, Floor, Wall

Balcony Floor/Wall 57s.42A
Balcony Ceiling/Wall 57s.42B

Installation at Dissimilar Materials

Horizontal Termination at Dissimilar Cladding 57s.50
Vertical Termination at Dissimilar Cladding 57s.51A
Vertical Termination at Dissimilar Backup Wall Construction 57s.51B
Vertical Expansion Joint in Back-Up Wall 57s.52A
Vertical Expansion Joint in Back-Up Wall - StoTherm ci and Dissimilar Cladding 57s.52B

Installation at Corners

Inside Corner with Dissimilar Backup 57s.53
Inside and Outside Corner with Common Substrate and Sto Mesh Corner Bead Reinforcement 57s.54A
Inside and Outside Corner with Common Substrate and Sto Mesh Reinforcement 57s.54B

Design Details (cont'd)

Installation at Joints

Thin Veneer Expansion Joint 57s.55

Installation at Parapet

Termination at Parapet - Front 57s.60A
Termination at Parapet - Back 57s.60B
Parapet with Cornice Feature 57s.61

Installation at Roof/Wall Abutment

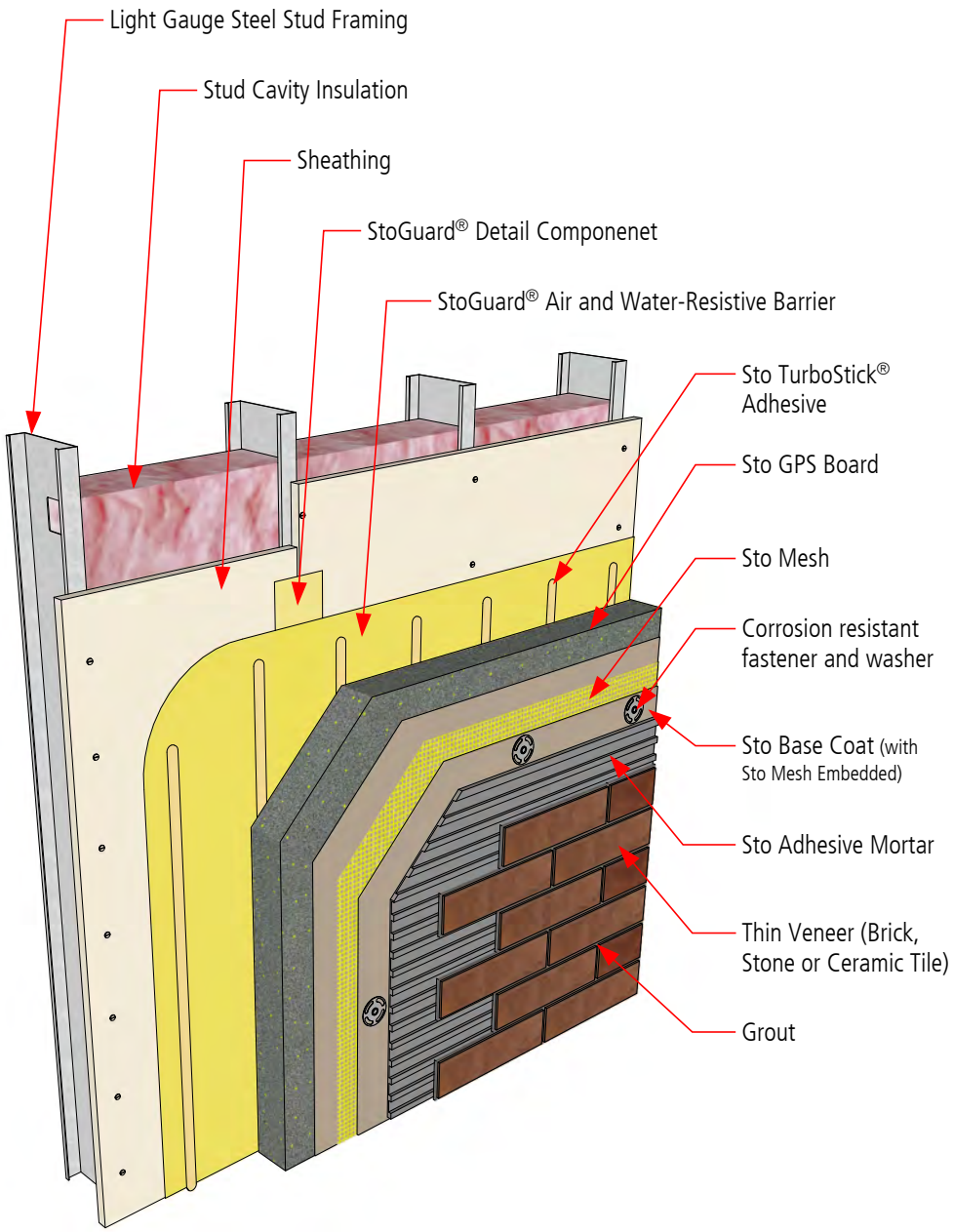
Diverter Flashing at Roof/Wall Abutment 57s.62
Gravel Stop 57s.63
Saddle Flashing at Lower/Higher Wall Abutment -Step 1 ..... 57s.64-1
Saddle Flashing at Lower/Higher Wall Abutment -Step 2 ..... 57s.64-2
Saddle Flashing at Lower/Higher Wall Abutment -Step 3 ..... 57s.64-3

Installation at Penetrations

Scupper Penetration 57s.65
Pipe Penetration - Precision Cut Sheathing 57s.70A
Pipe Penetration - Rough Cut Sheathing 57s.70B
Sign Attachment 57s.71
Fixture Attachment 57s.73
Deck Connection over Steel Frame 57s.74

StoTherm® ci MVES
System Components

Detail No.: 57s.00
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

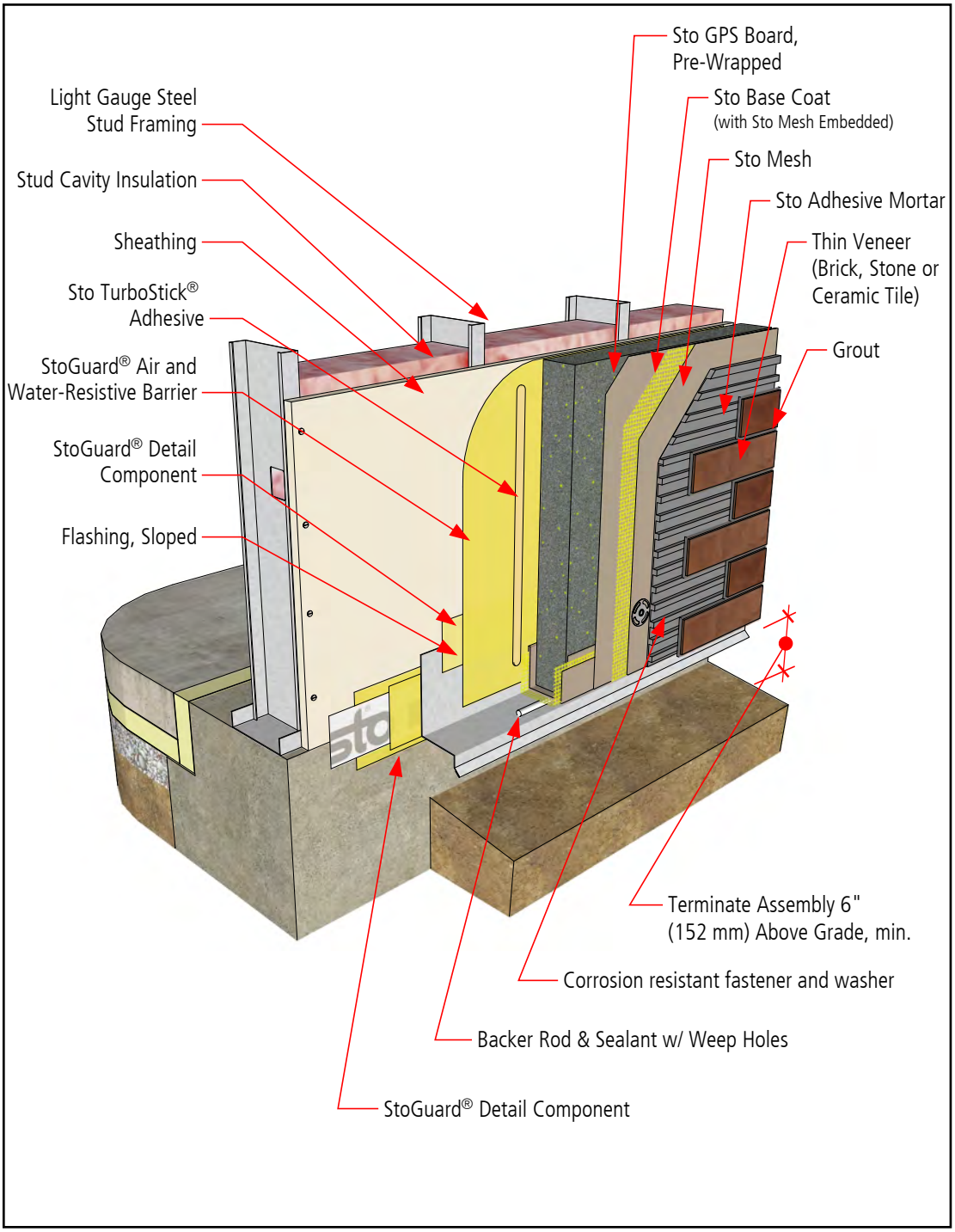
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Termination at Grade - Sheathing Flush with Foundation or Slab Edge

Detail No.: 57s.03A
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

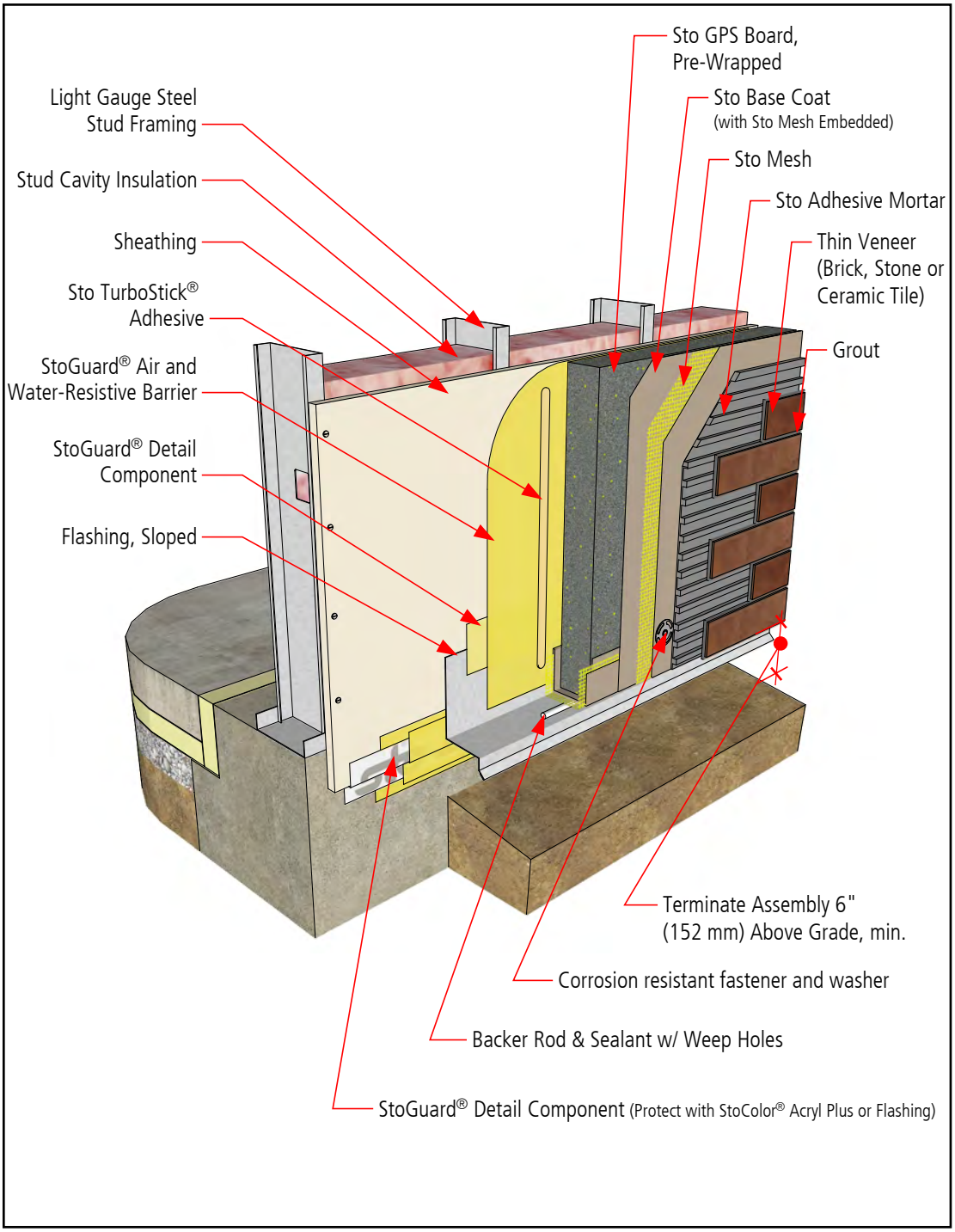
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Termination at Grade - Sheathing Overlapping Slab or Foundation

Detail No.: 57s.03B
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

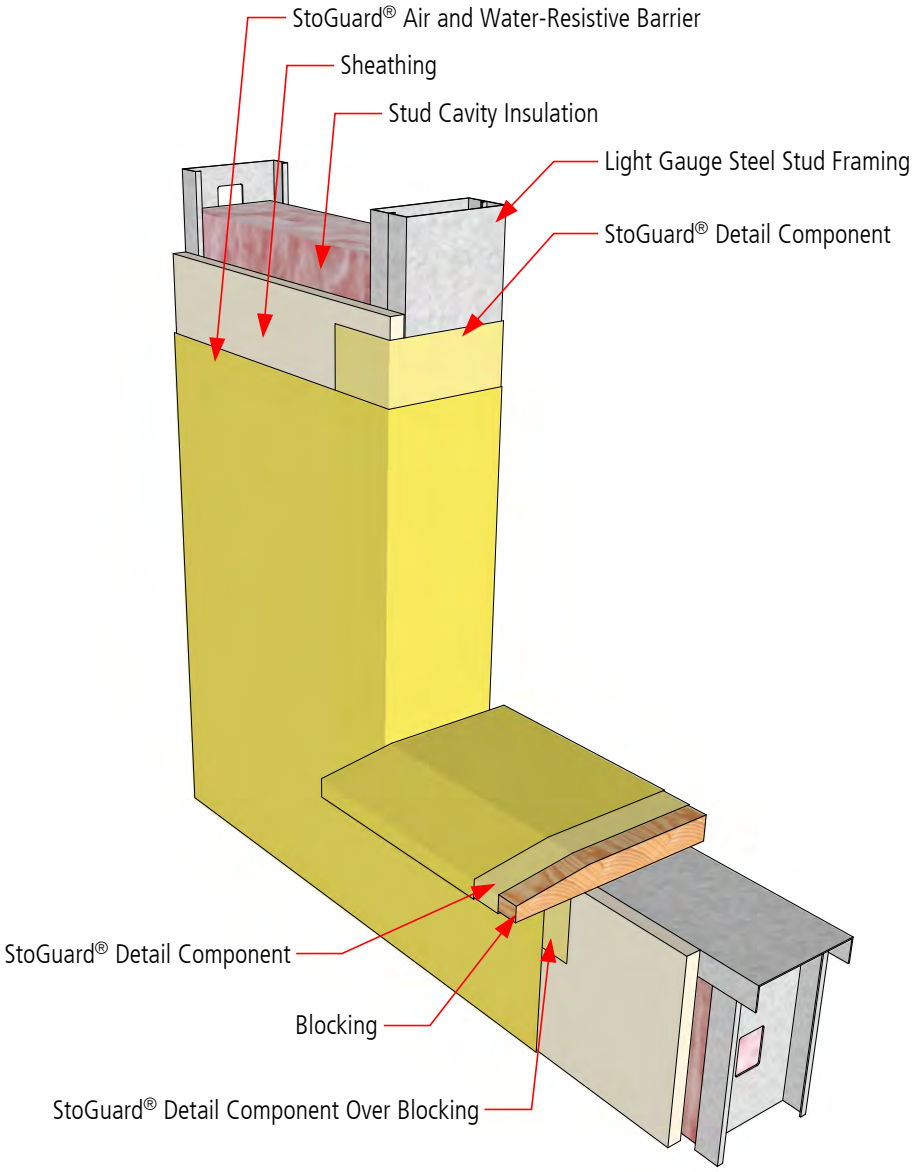
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Receptor-Type Window Sill

Detail No.: 57s.23A-1
Date: August 2023



Step 1 - Rough Opening Protection

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

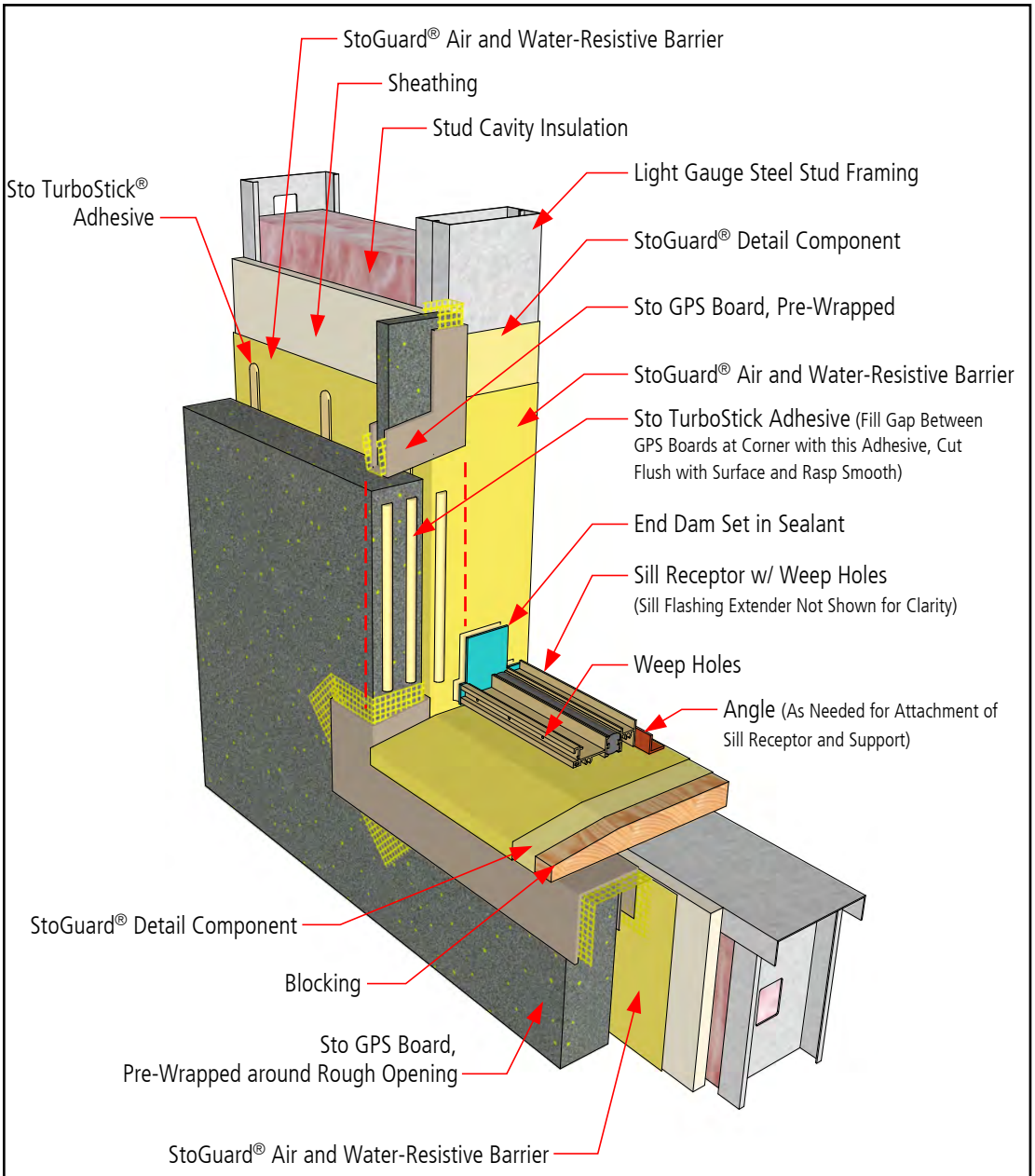
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Receptor-Type Window Sill

Detail No.: 57s.23A-2
Date: August 2023



Step 2 - Receptor with End Dam

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

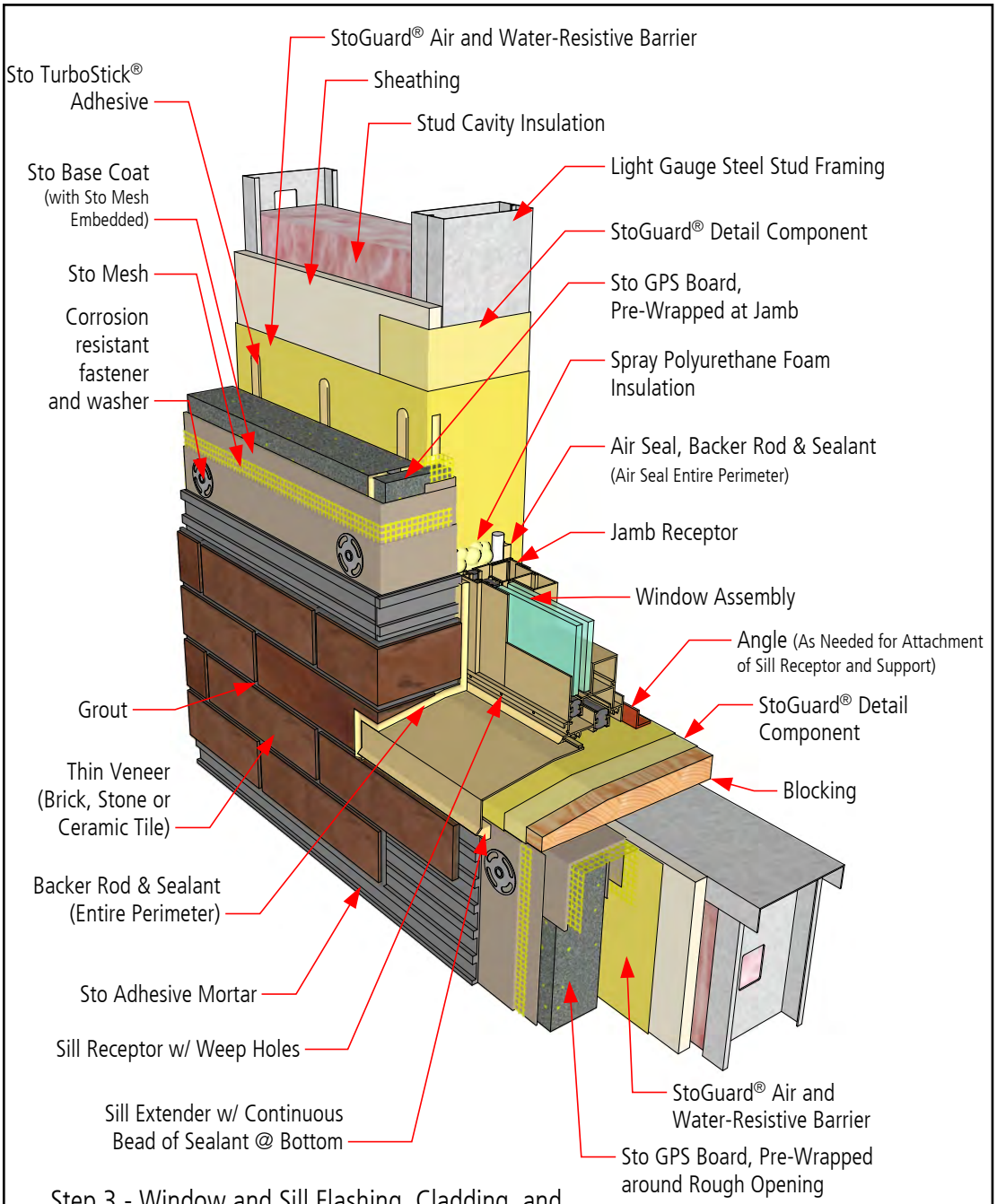
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Receptor-Type Window Sill

Detail No.: 57s.23A-3
Date: August 2023



Step 3 - Window and Sill Flashing, Cladding, and Perimeter Weather and Air Seals

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

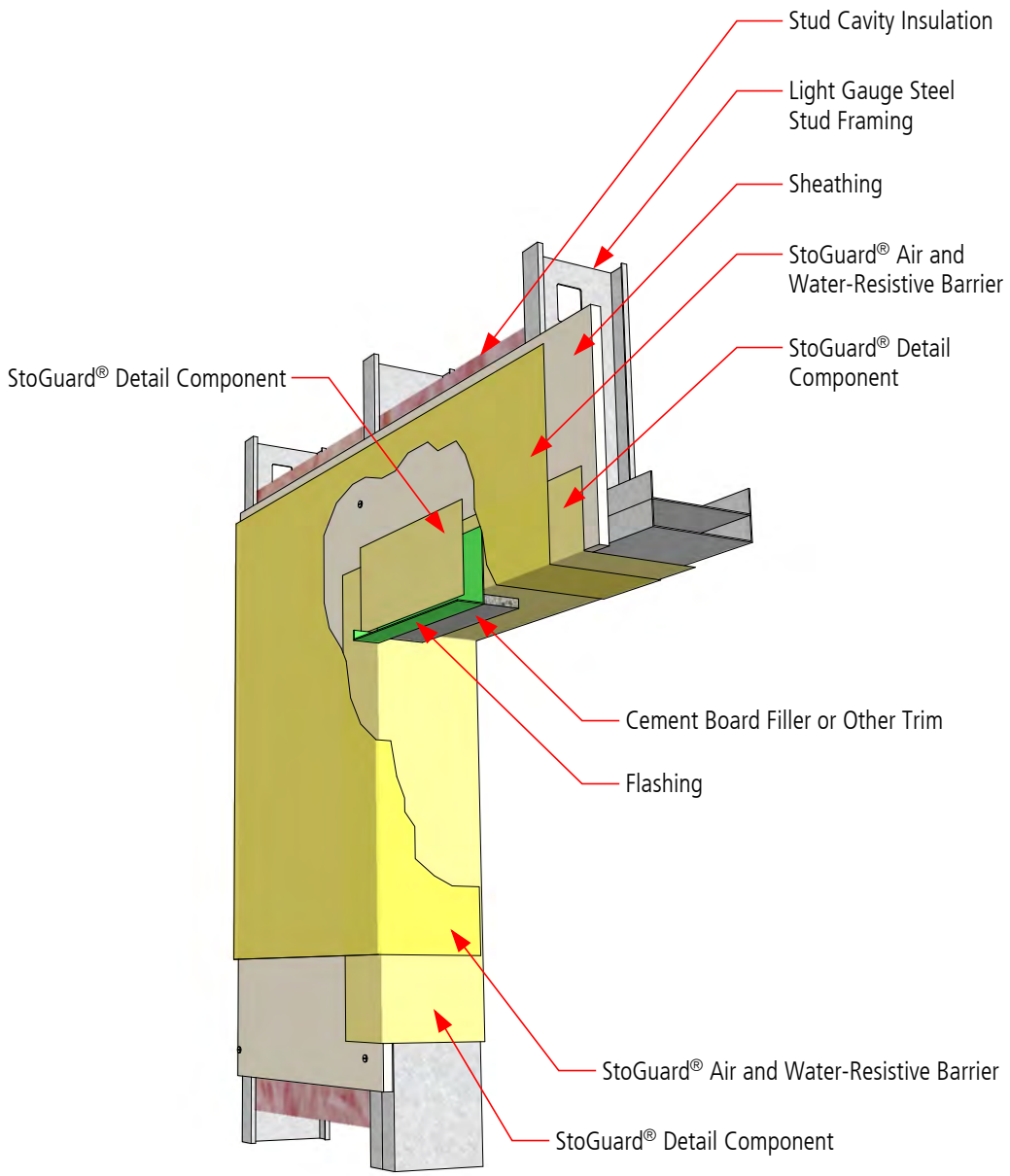
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Receptor-Type Window Head

Detail No.: 57s.23B-1
Date: August 2023



Step 1 - Rough Opening Protection, Head Flashing

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

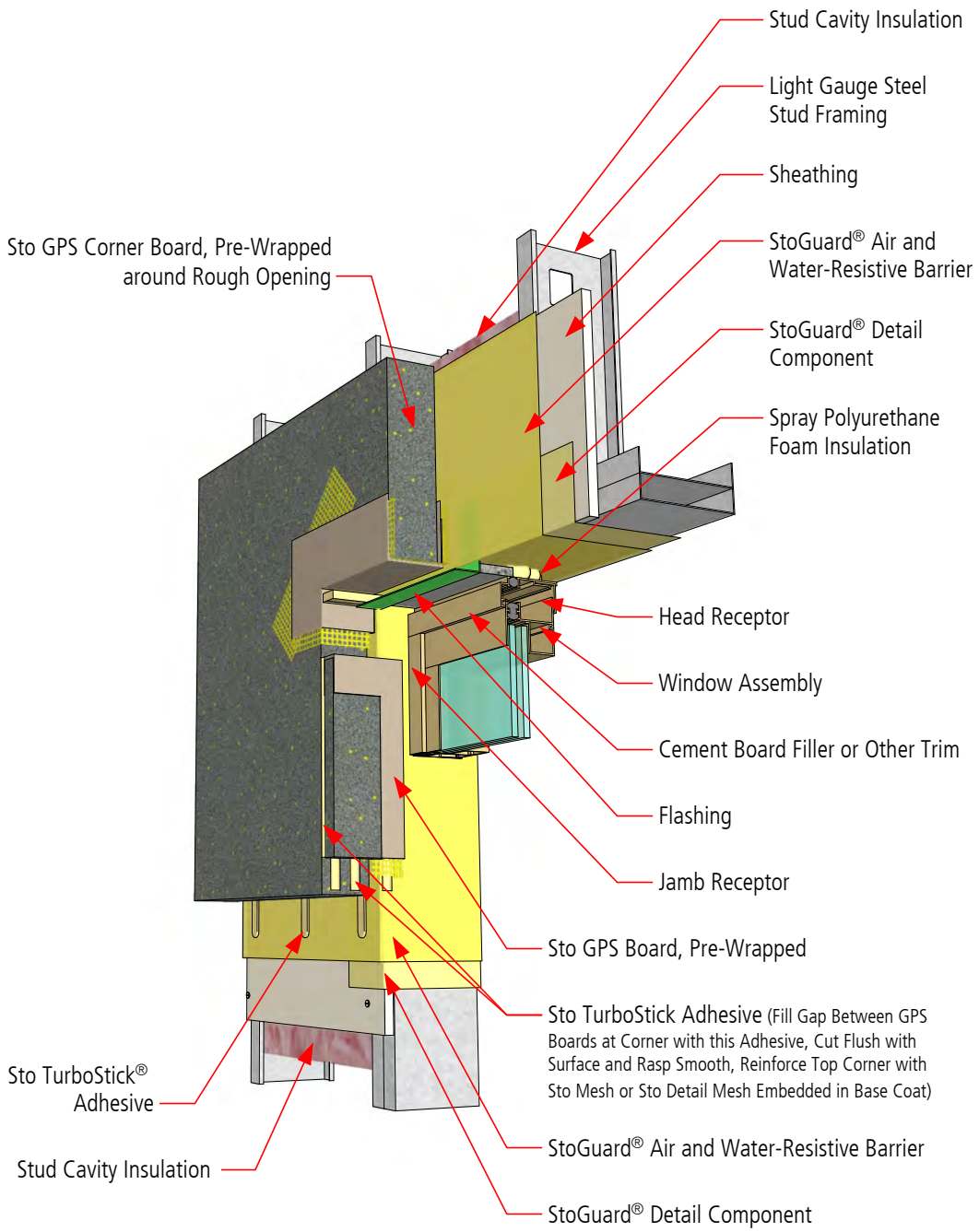
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Receptor-Type Window Head

Detail No.: 57s.23B-2
Date: August 2023



Step 2 - Receptor and Window

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

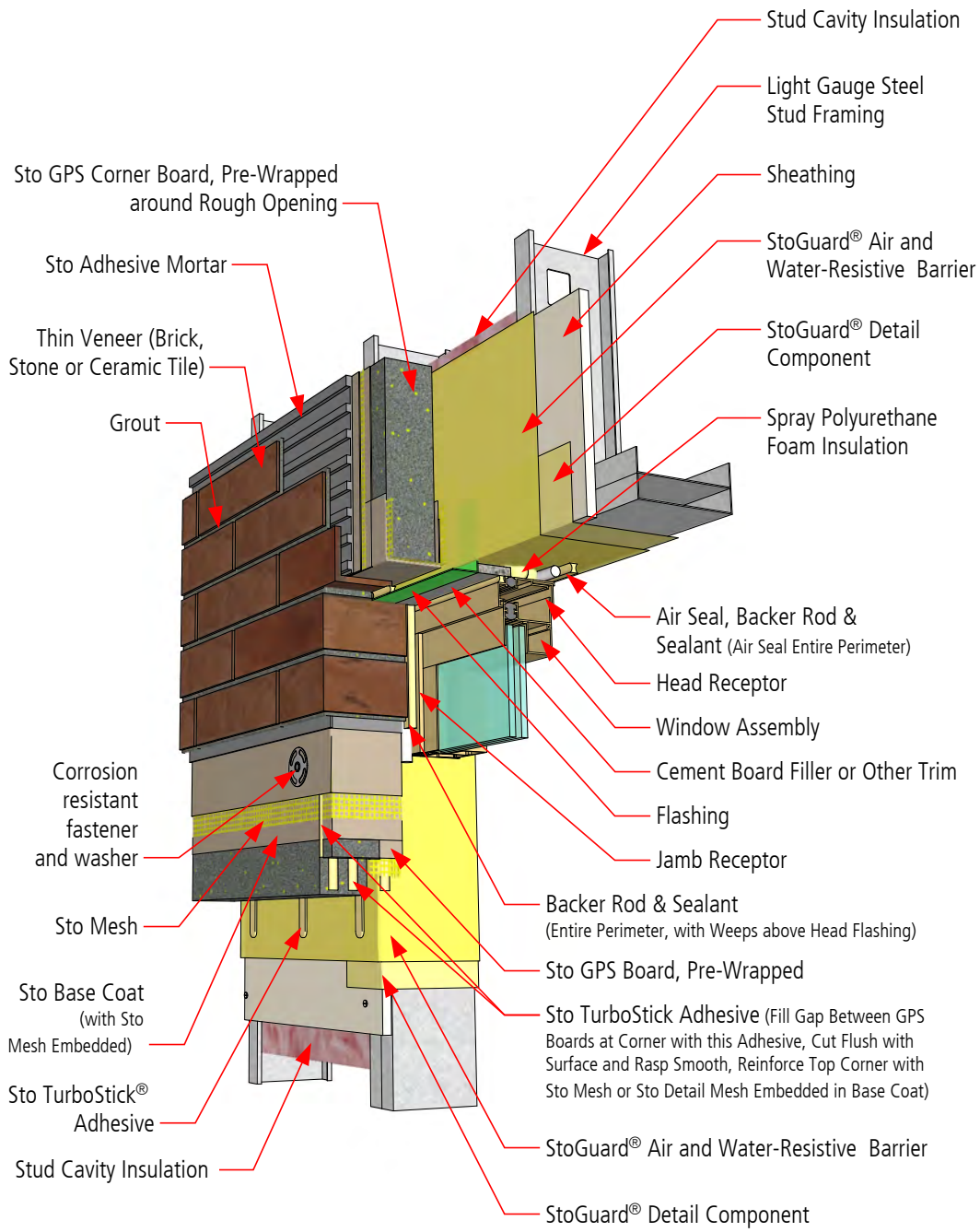
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Receptor-Type Window Head

Detail No.: 57s.23B-3
Date: August 2023



Step 3 - Cladding and Perimeter Weather and Air Seals

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

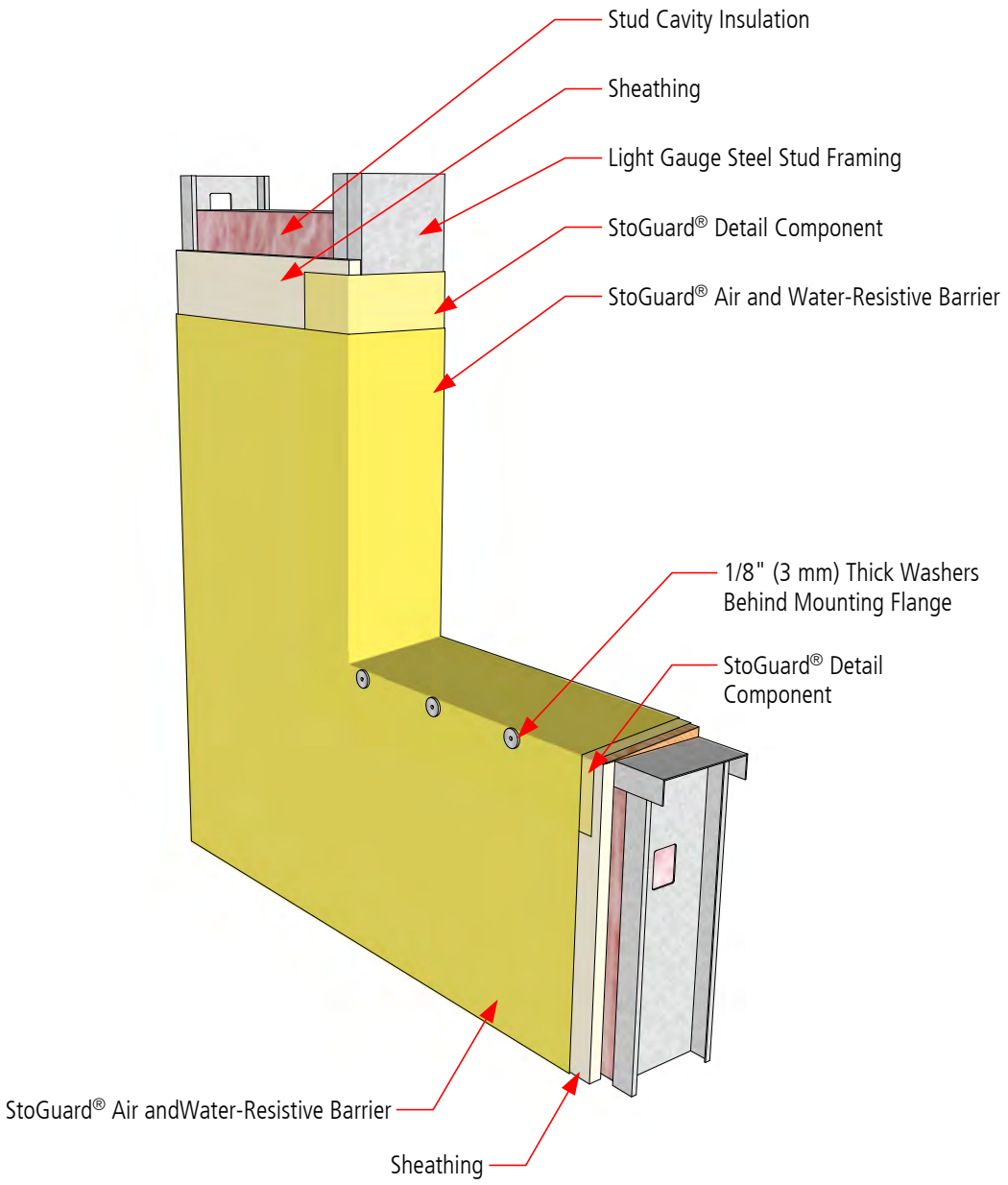
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Flanged Window-Sill

Detail No.: 57s.24A-1
Date: August 2023



Step 1 - Rough Opening Protection

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

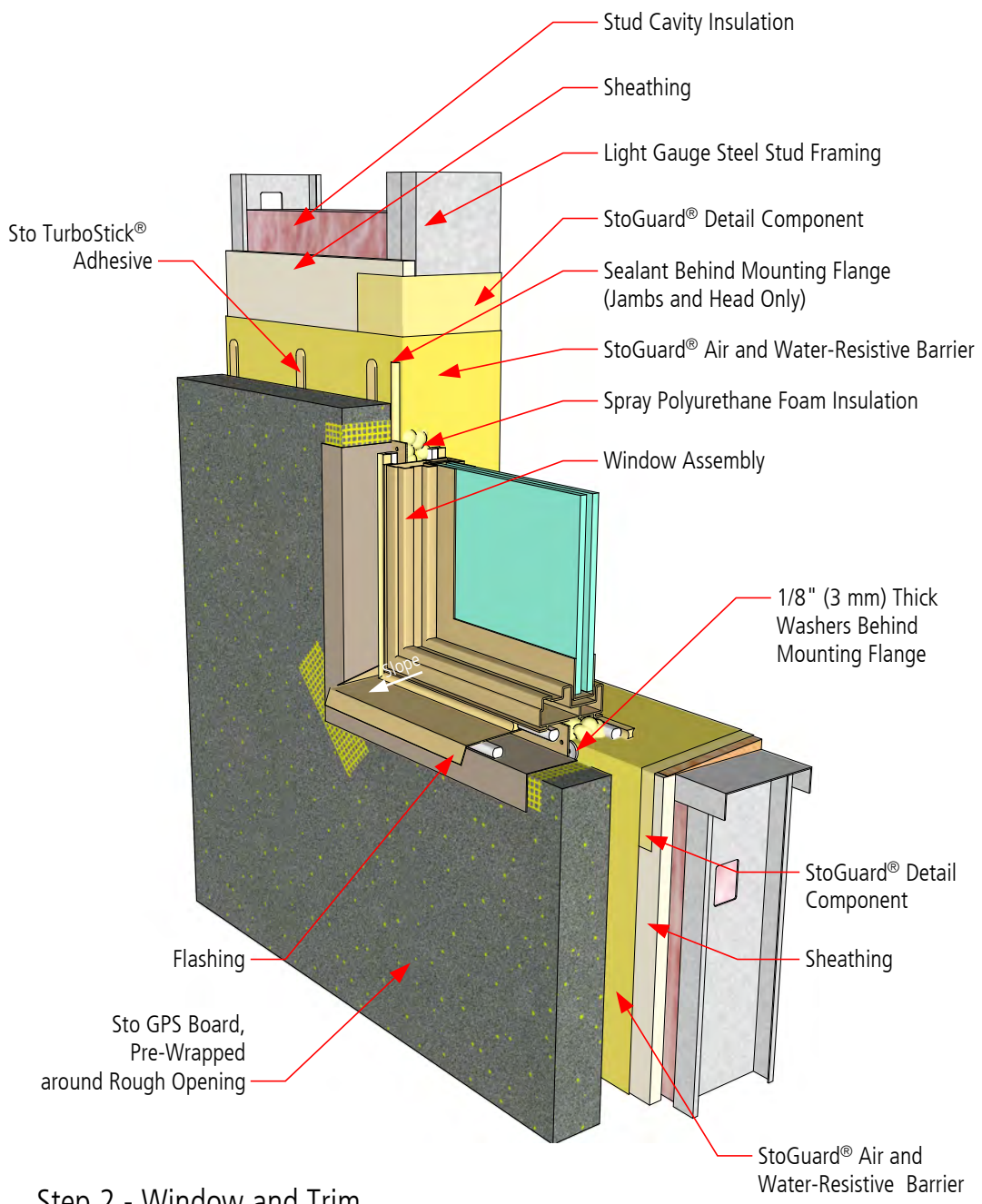
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Flanged Window-Sill

Detail No.: 57s.24A-2
Date: August 2023



Step 2 - Window and Trim

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

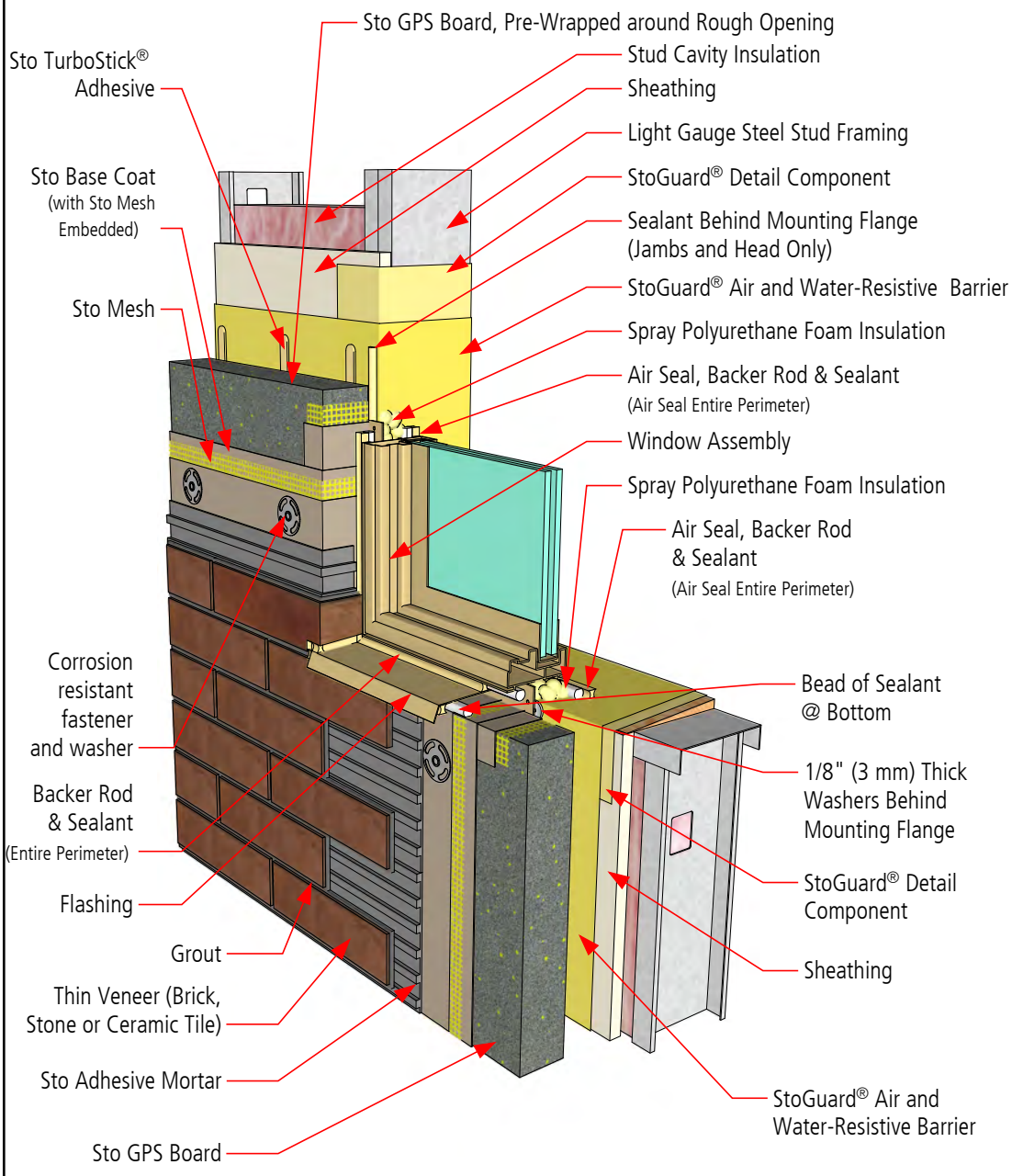
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Flanged Window-Sill

Detail No.: 57s.24A-3
Date: August 2023



Step 3 - Cladding and Perimeter Weather and Air Seals

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

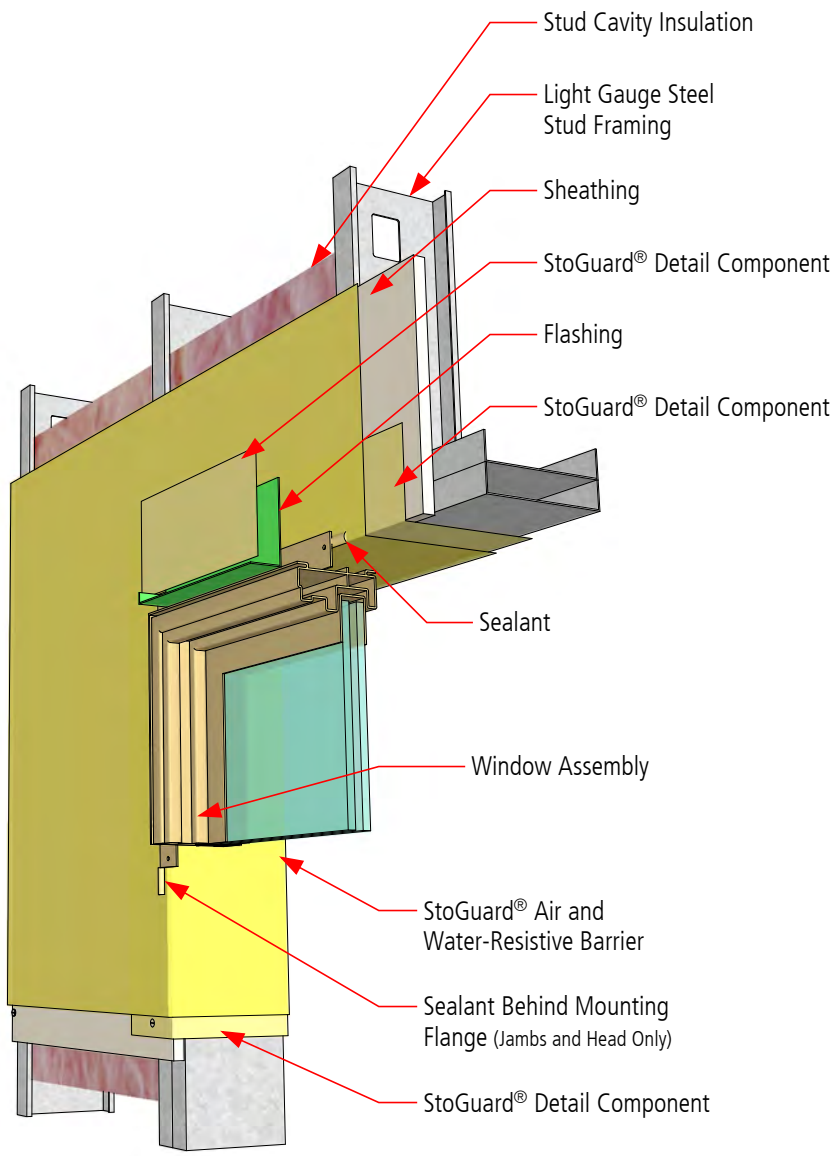
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Flanged Window-Head

Detail No.: 57s.24B-1
Date: August 2023



Step 1 - Rough Opening Protection, Head Flashing

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

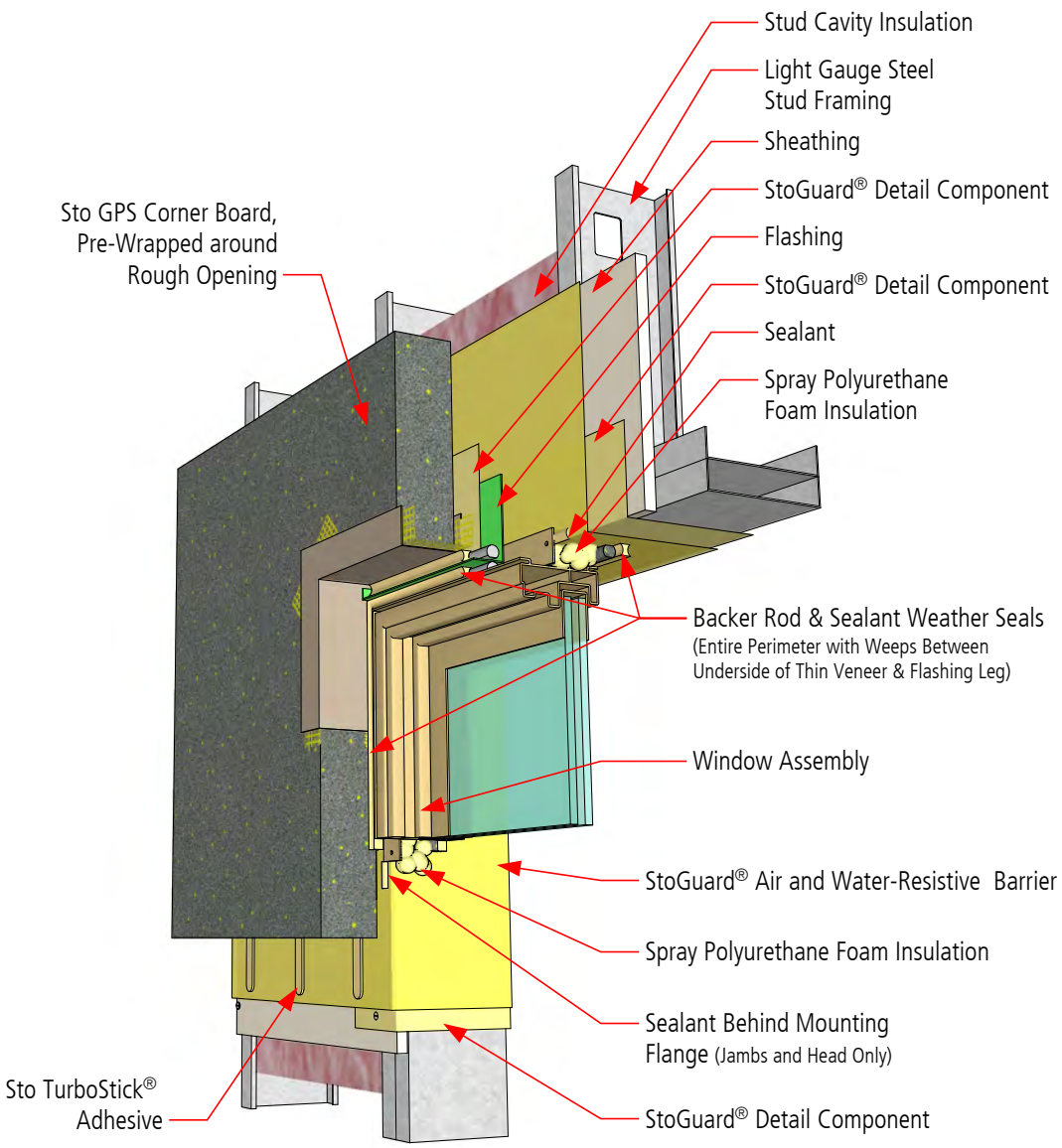
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Flanged Window-Head

Detail No.: 57s.24B-2
Date: August 2023



Step 2 - Window and Trim

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

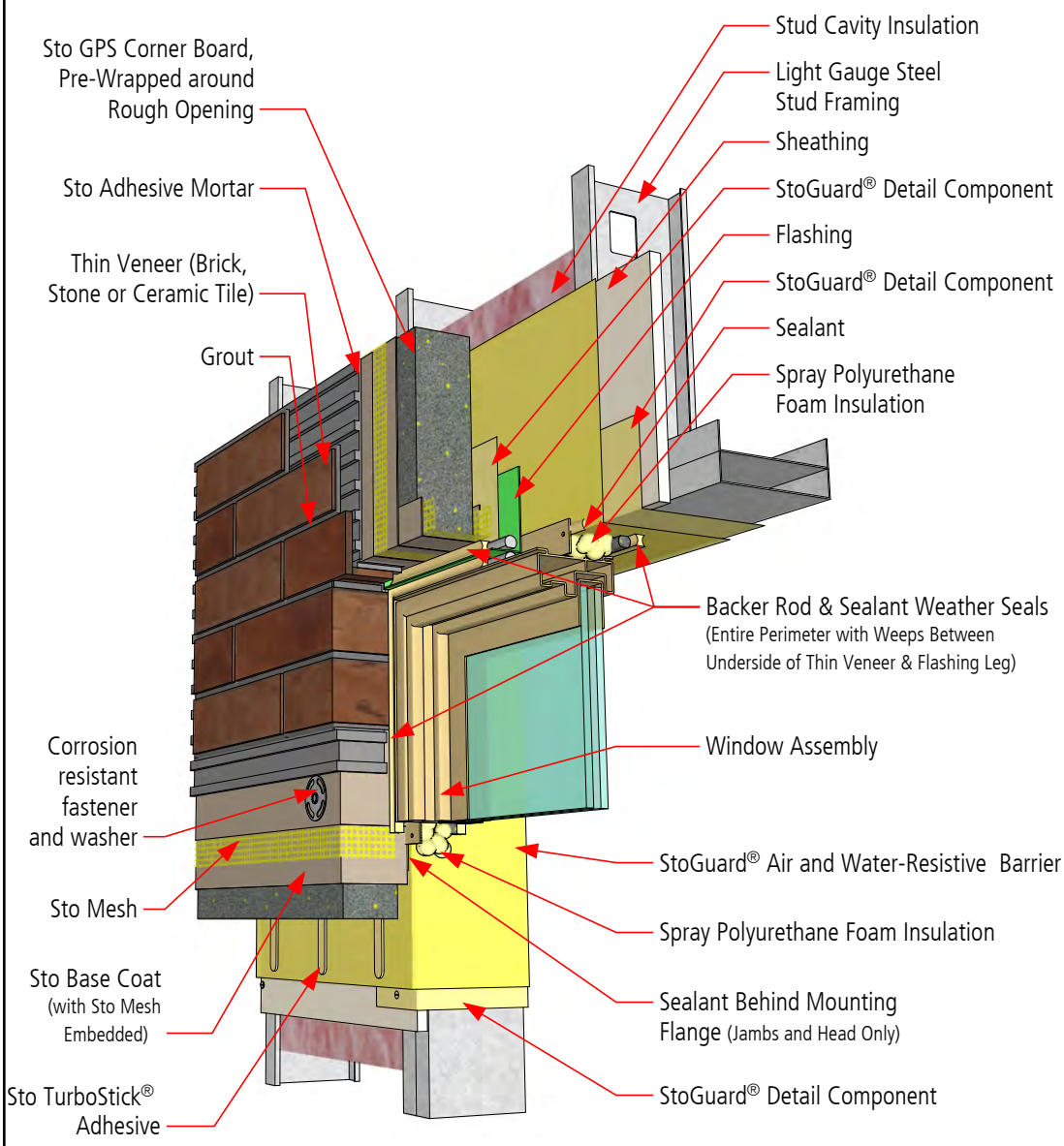
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Flanged Window-Head

Detail No.: 57s.24B-3
Date: August 2023



Step 3 - Cladding and Perimeter Weather and Air Seals

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

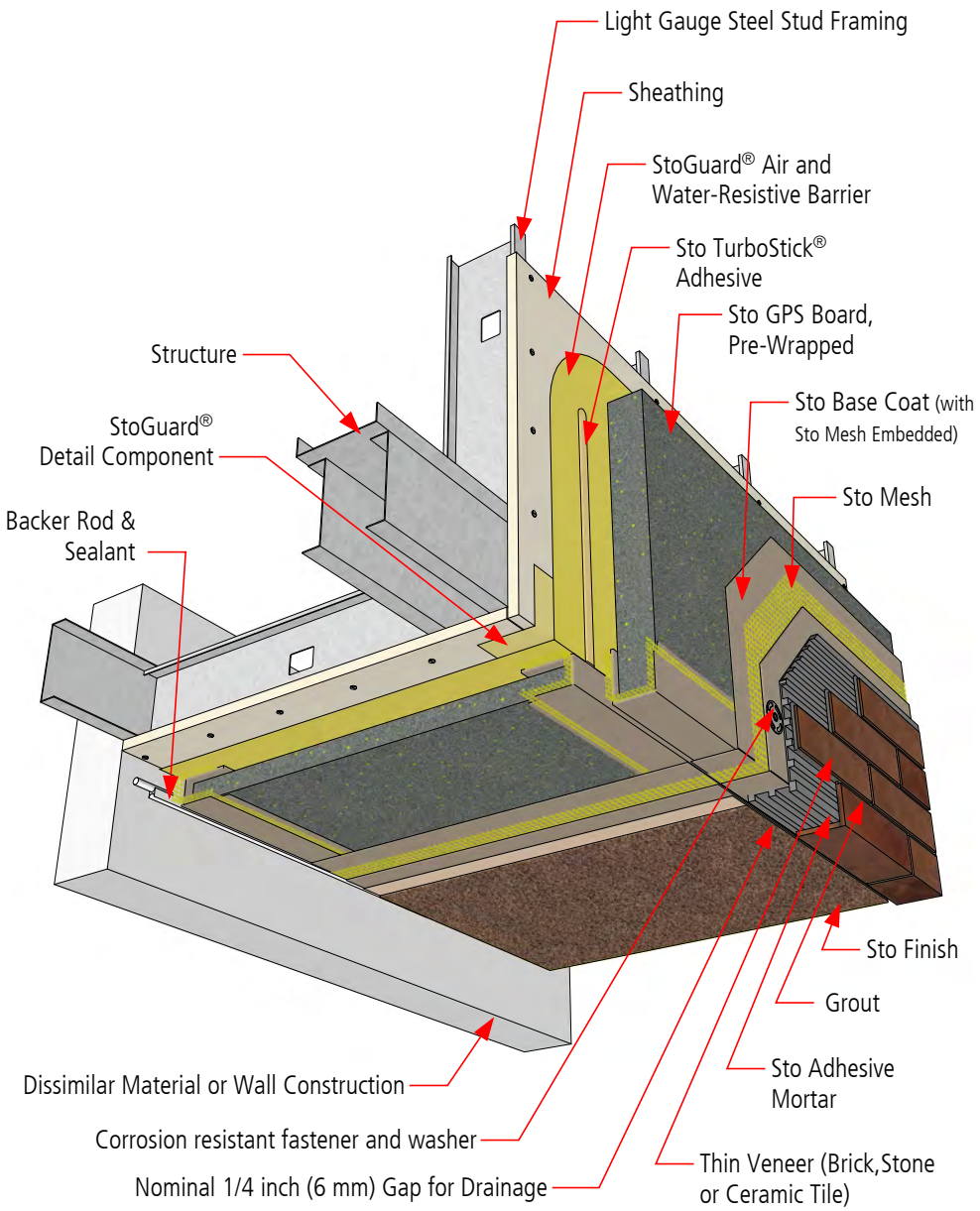
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Soffit: Insulated and Unvented

Detail No.: 57s.30
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

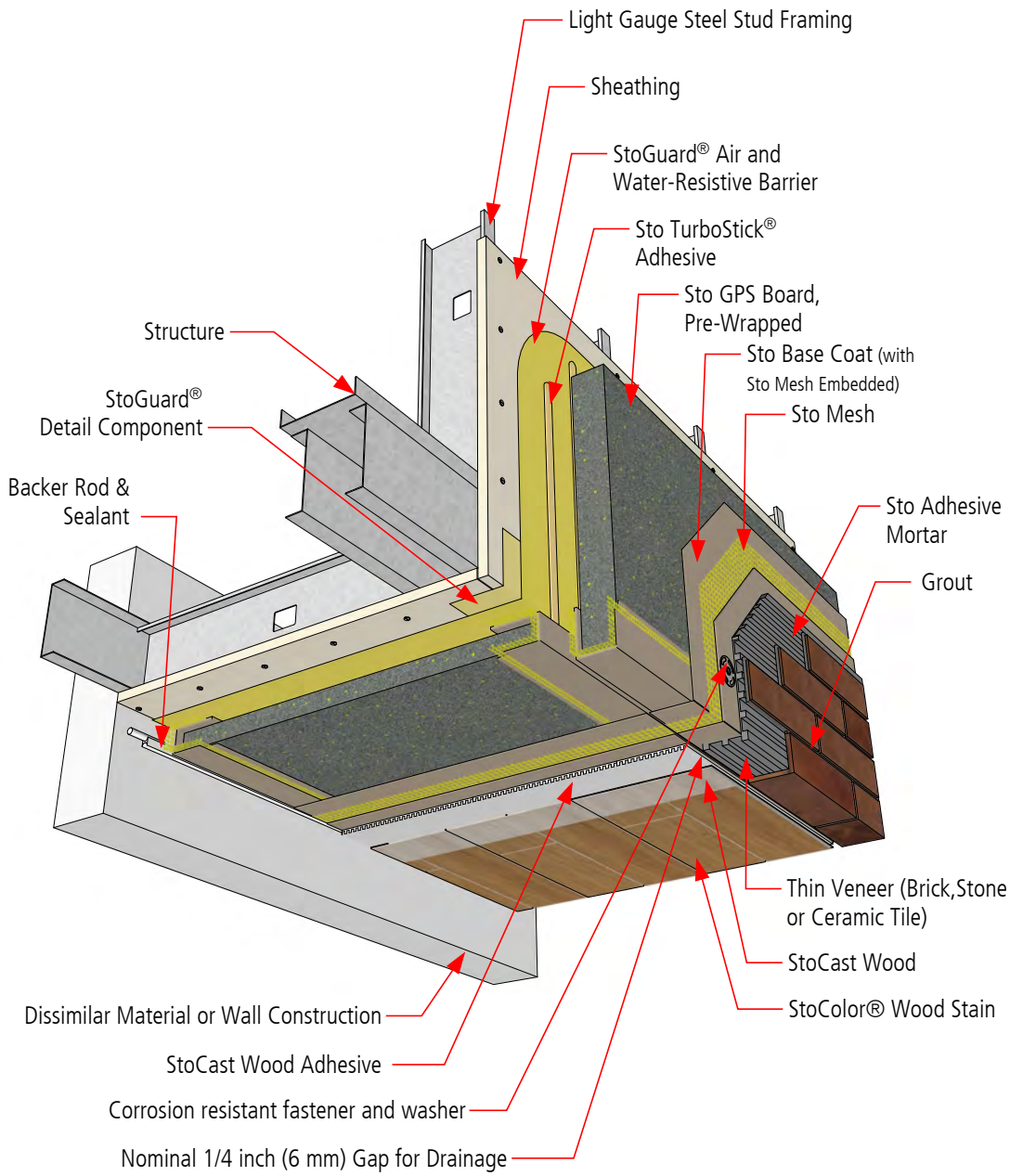
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Soffit: Insulated and Unvented

Detail No.: 57s.30 SCW
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

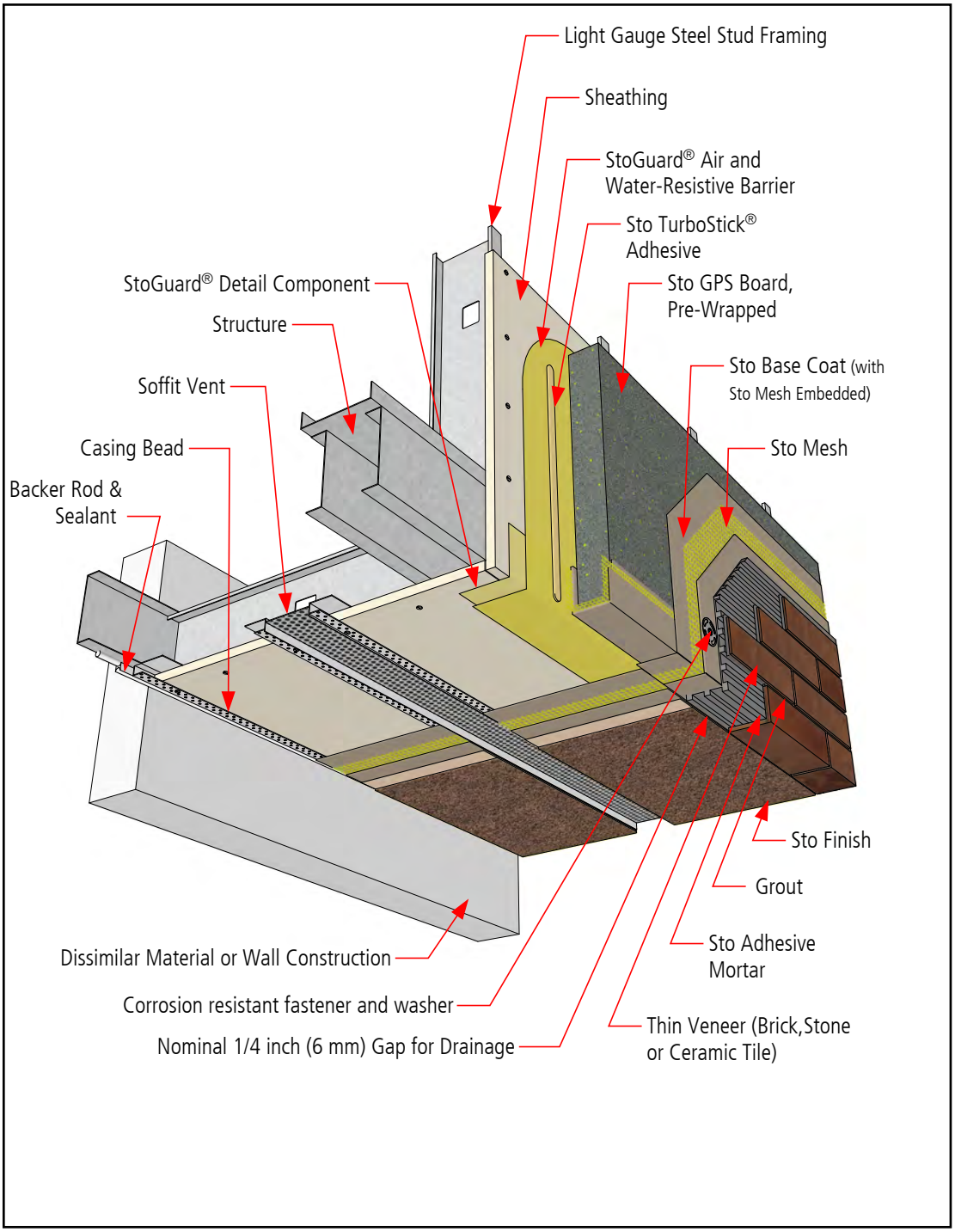
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Soffit: Uninsulated and Vented

Detail No.: 57s.31
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

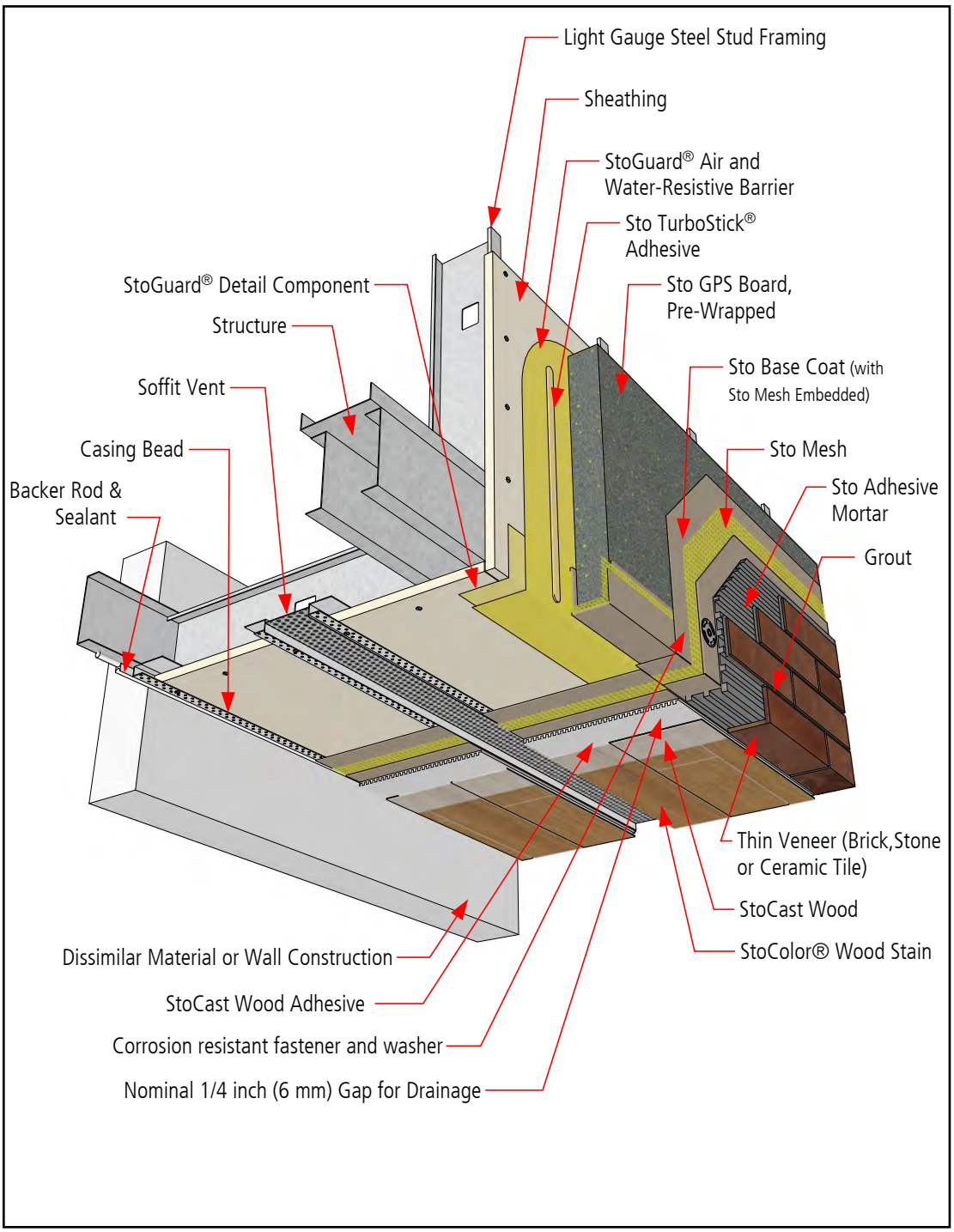
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Soffit: Uninsulated and Vented

Detail No.: 57s.31 SCW
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

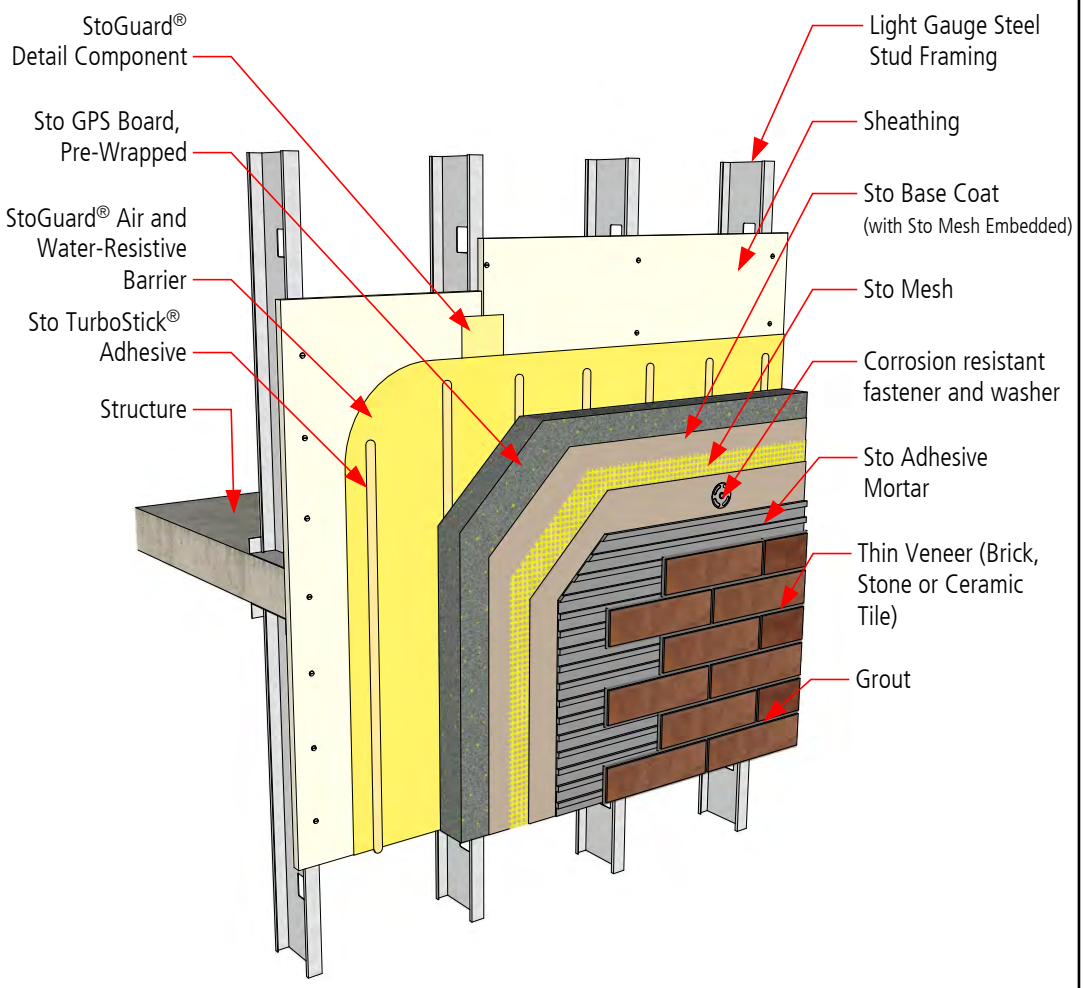
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Floor Line Without Deflection

Detail No.: 57s.40
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

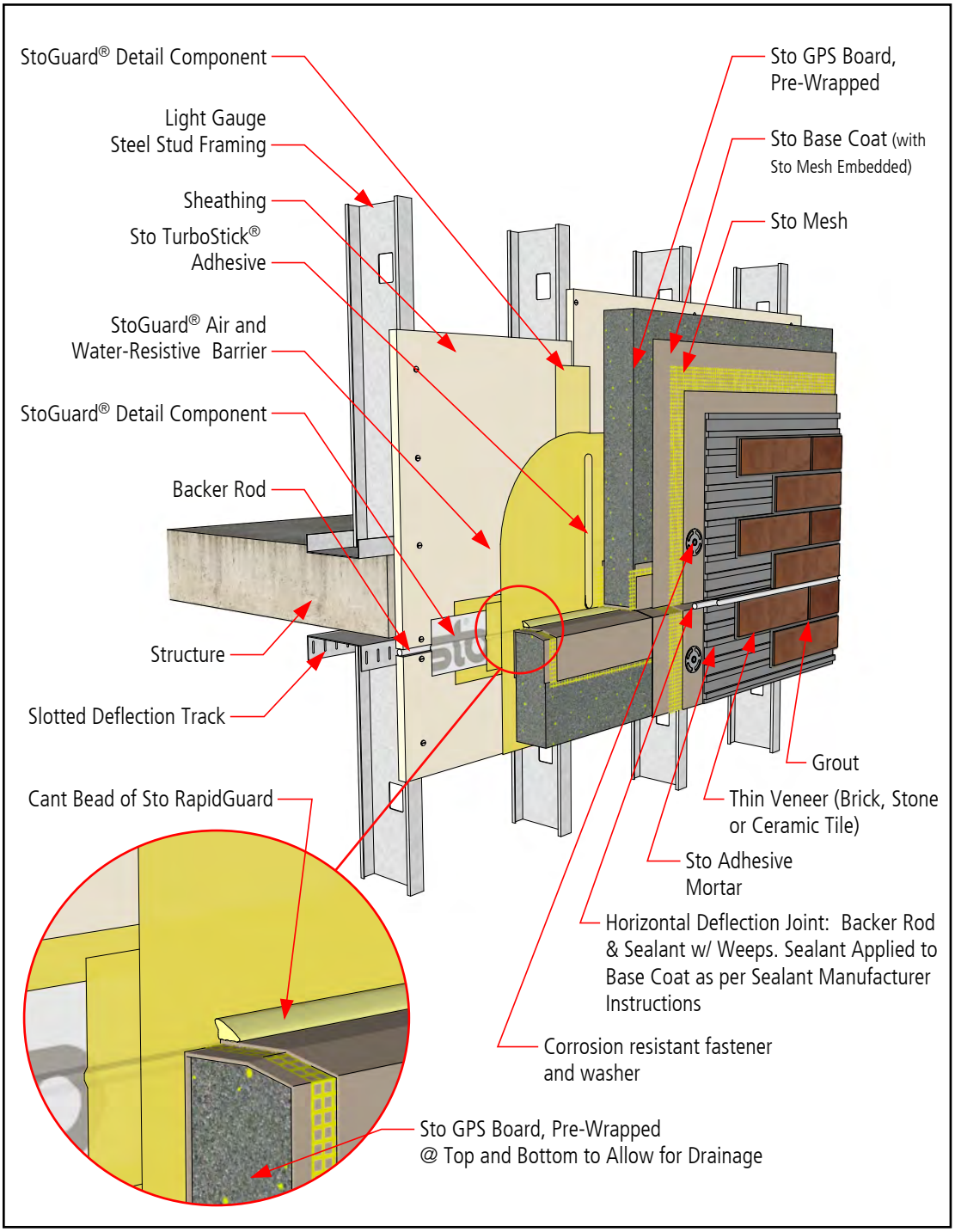
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Floor Line With Deflection - Concealed Flashing and Drainage at Floor Line

Detail No.: 57s.41A
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

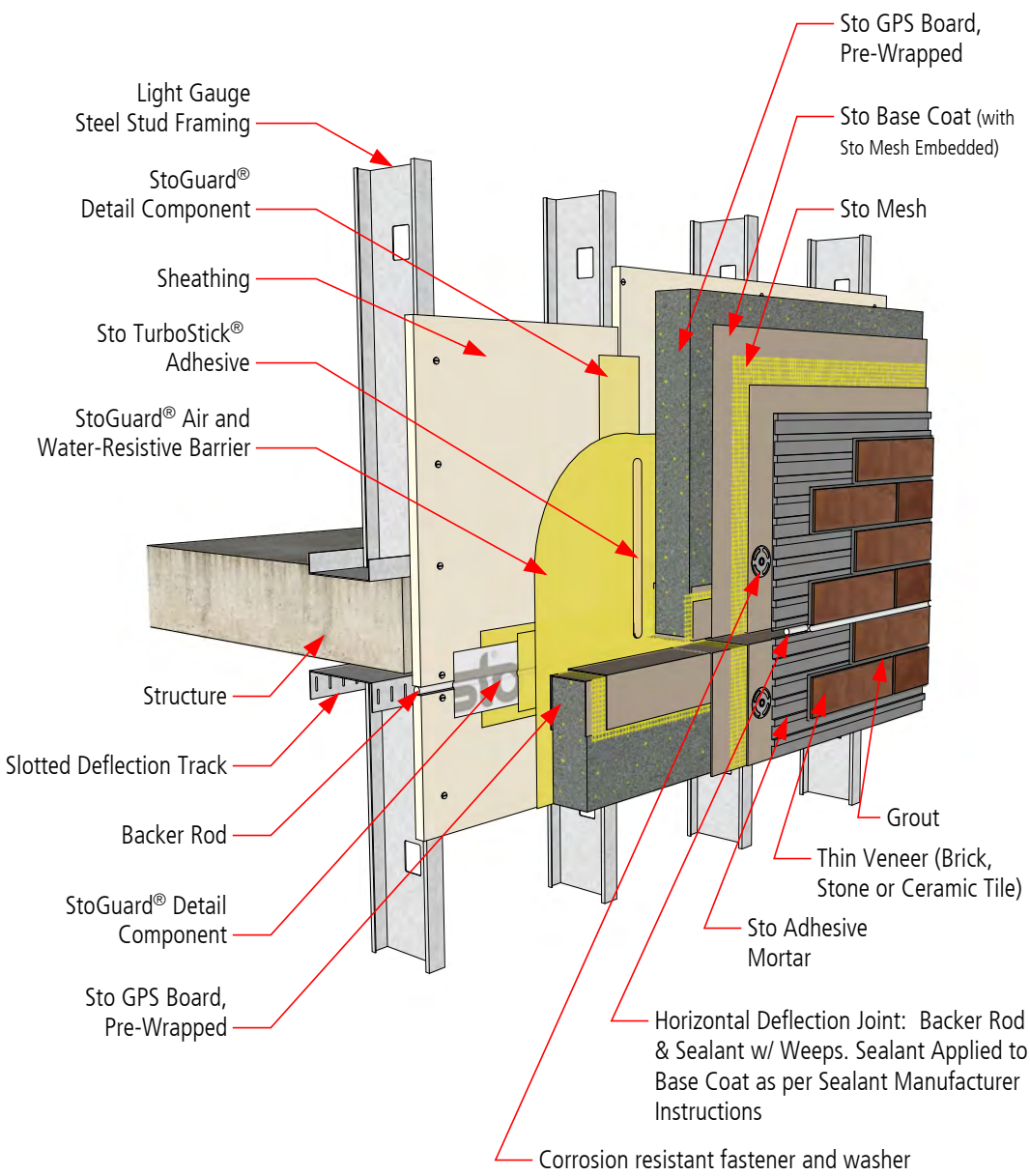
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Floor Line With Deflection - No Drainage at Floor Line

Detail No.: 57s.41B
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

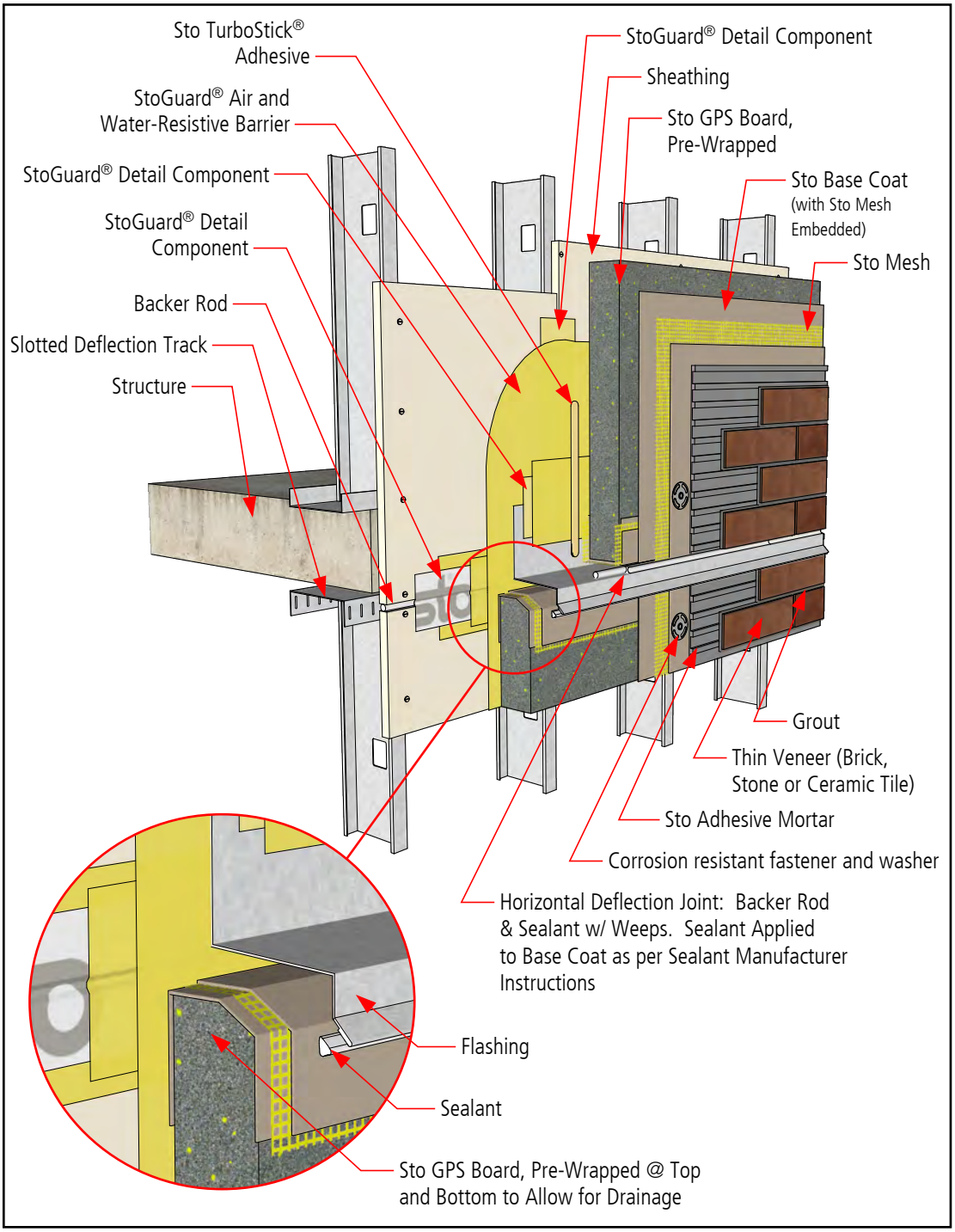
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Floor Line With Deflection - Flashing and Drainage at Floor Line

Detail No.: 57s.41C
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

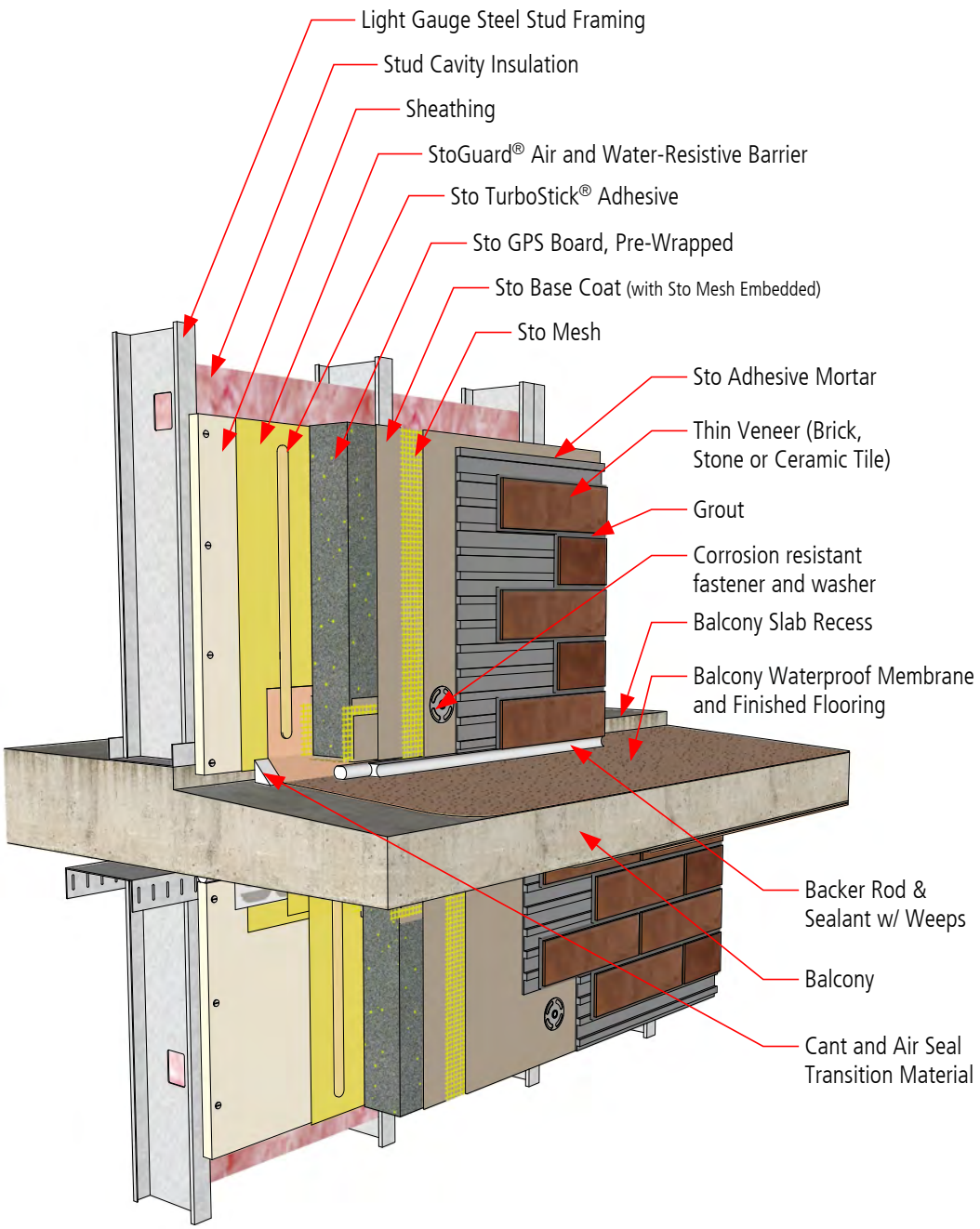
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Balcony Floor/Wall

Detail No.: 57s.42A
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

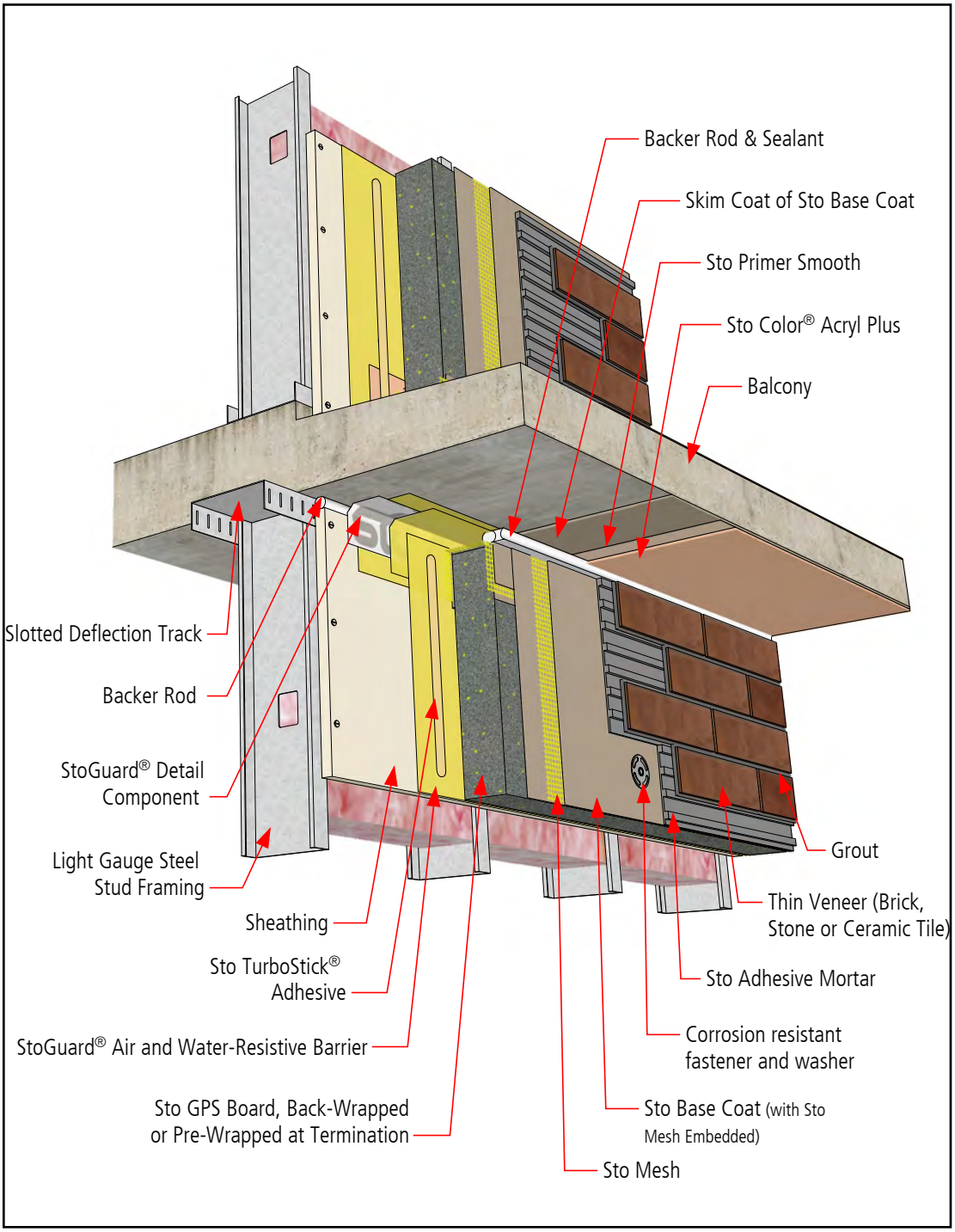
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Balcony Ceiling/Wall

Detail No.: 57s.42B
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

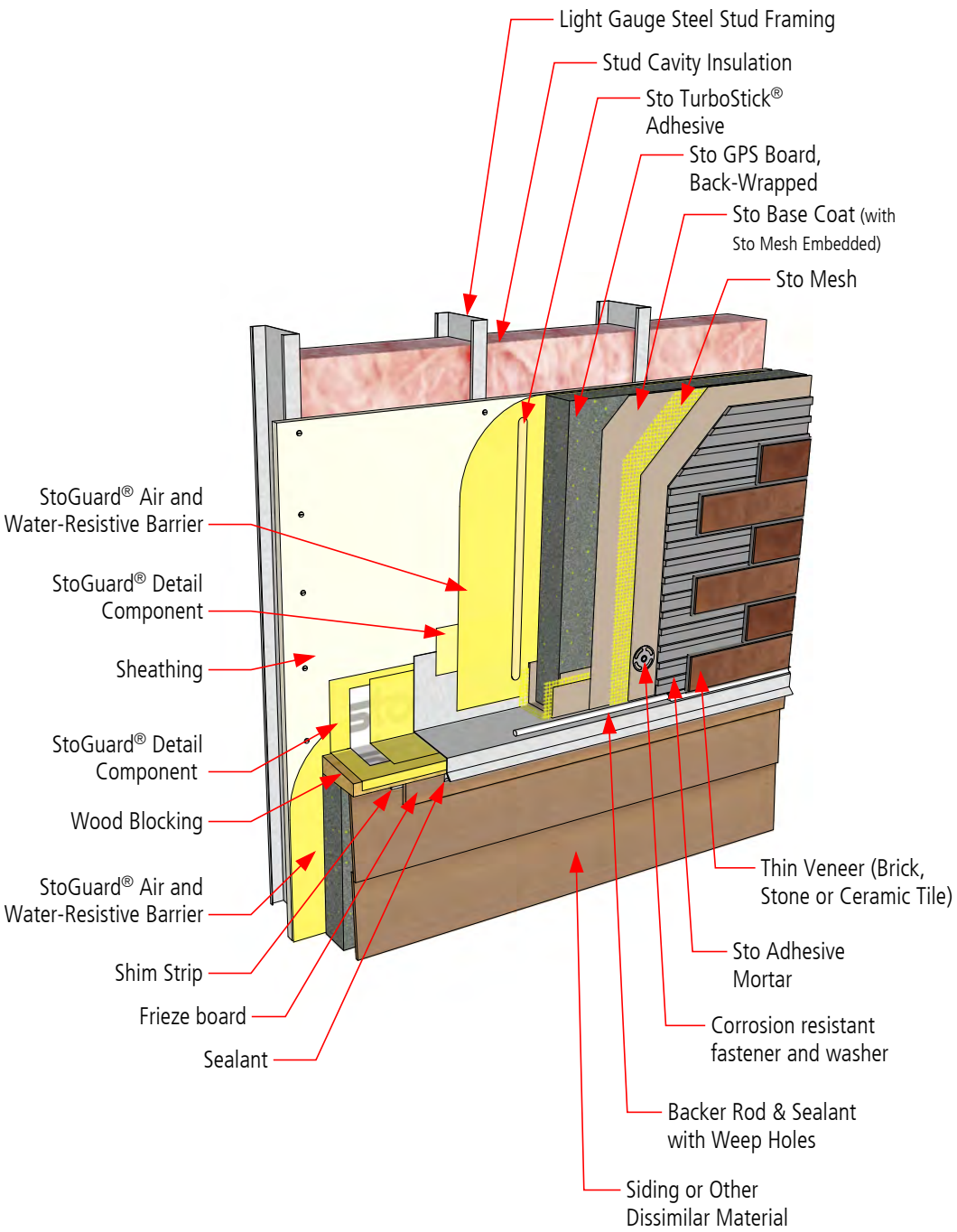
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Horizontal Termination at Dissimilar Cladding

Detail No.: 57s.50
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

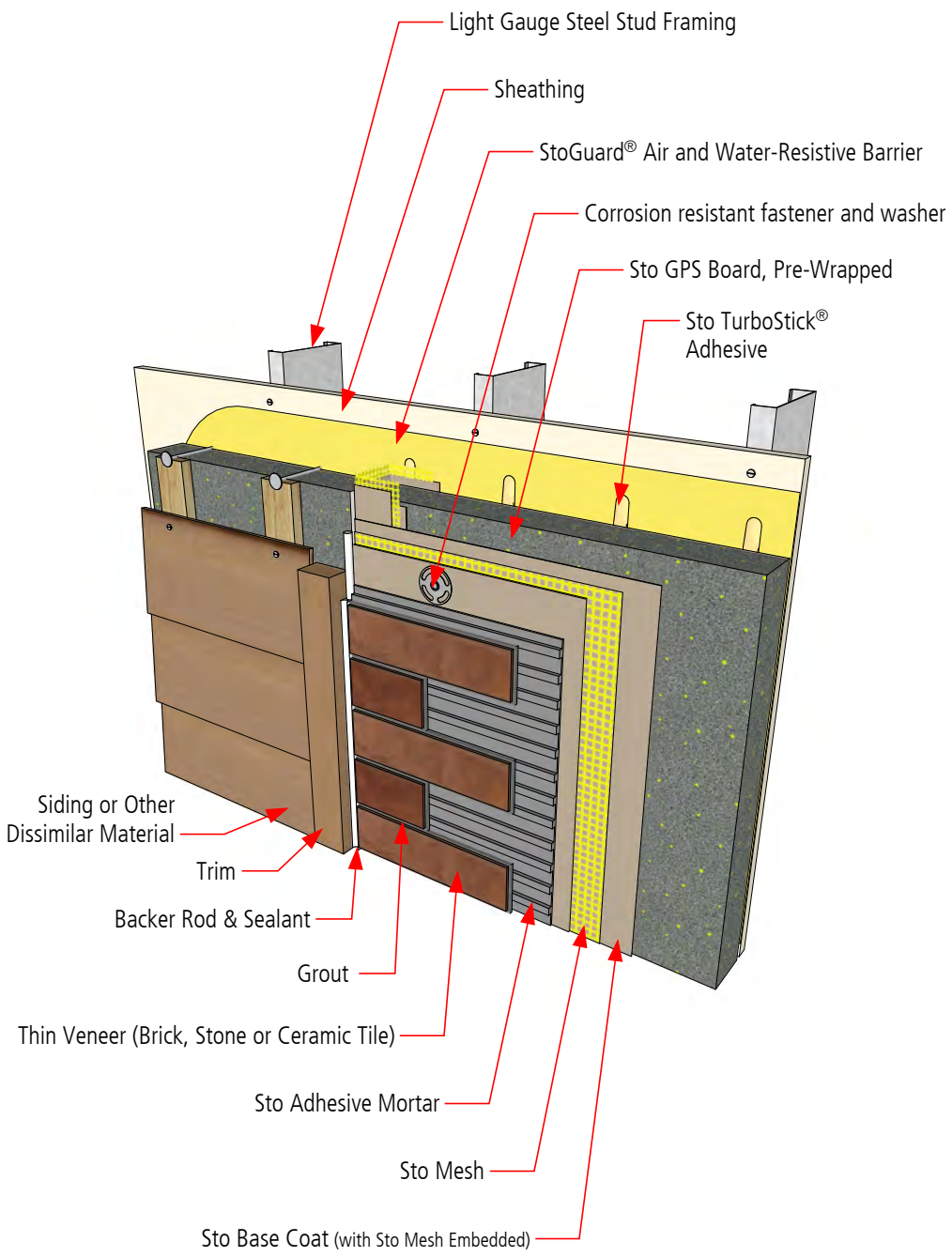
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Vertical Termination at Dissimilar Cladding

Detail No.: 57s.51A
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

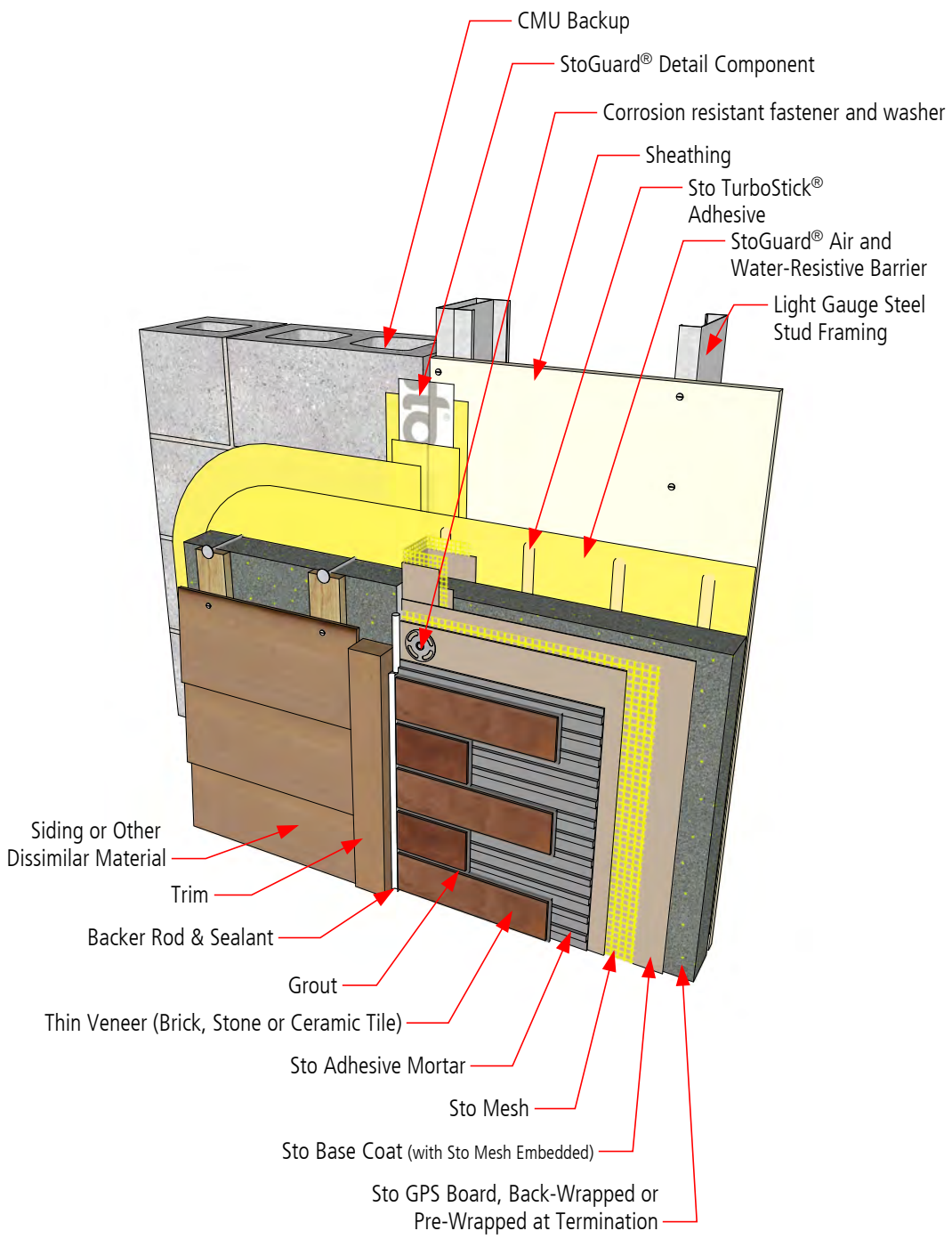
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Vertical Termination at Dissimilar Backup Wall Construction

Detail No.: 57s.51B
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

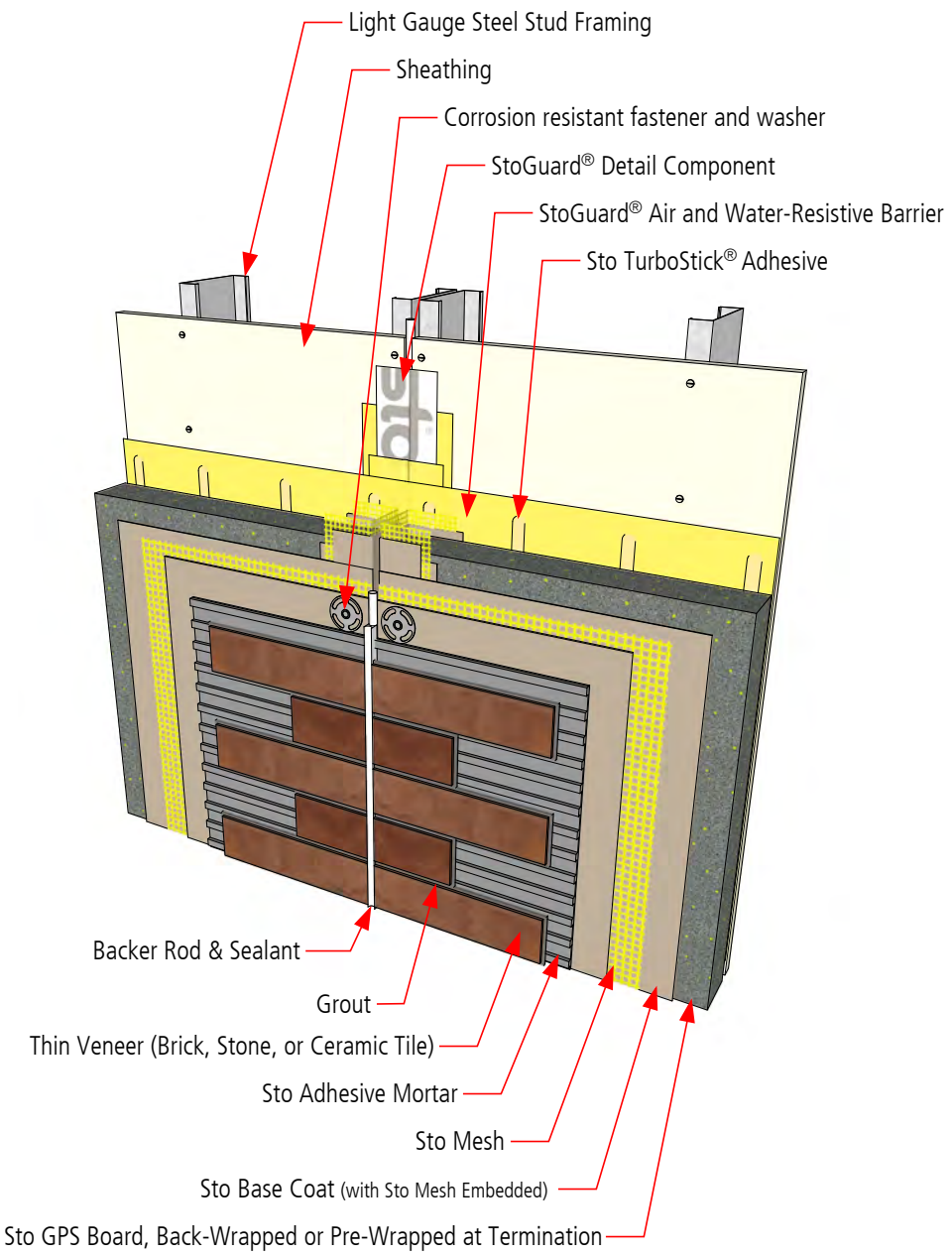
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Vertical Expansion Joint in Back-Up Wall

Detail No.: 57s.52A
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

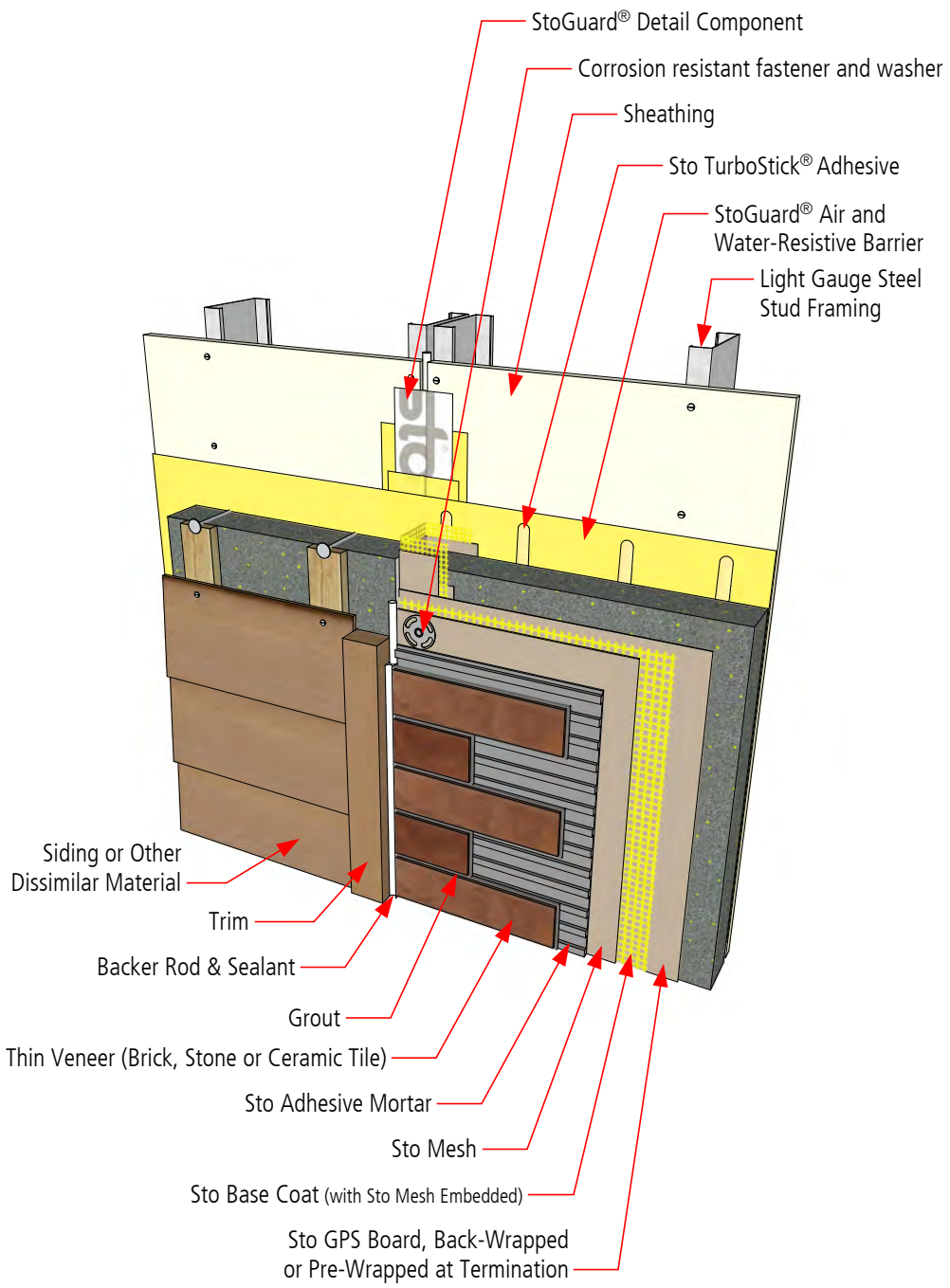
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Vertical Expansion Joint in Back-Up Wall, StoTherm ci and Dissimilar Cladding

Detail No.: 57s.52B
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

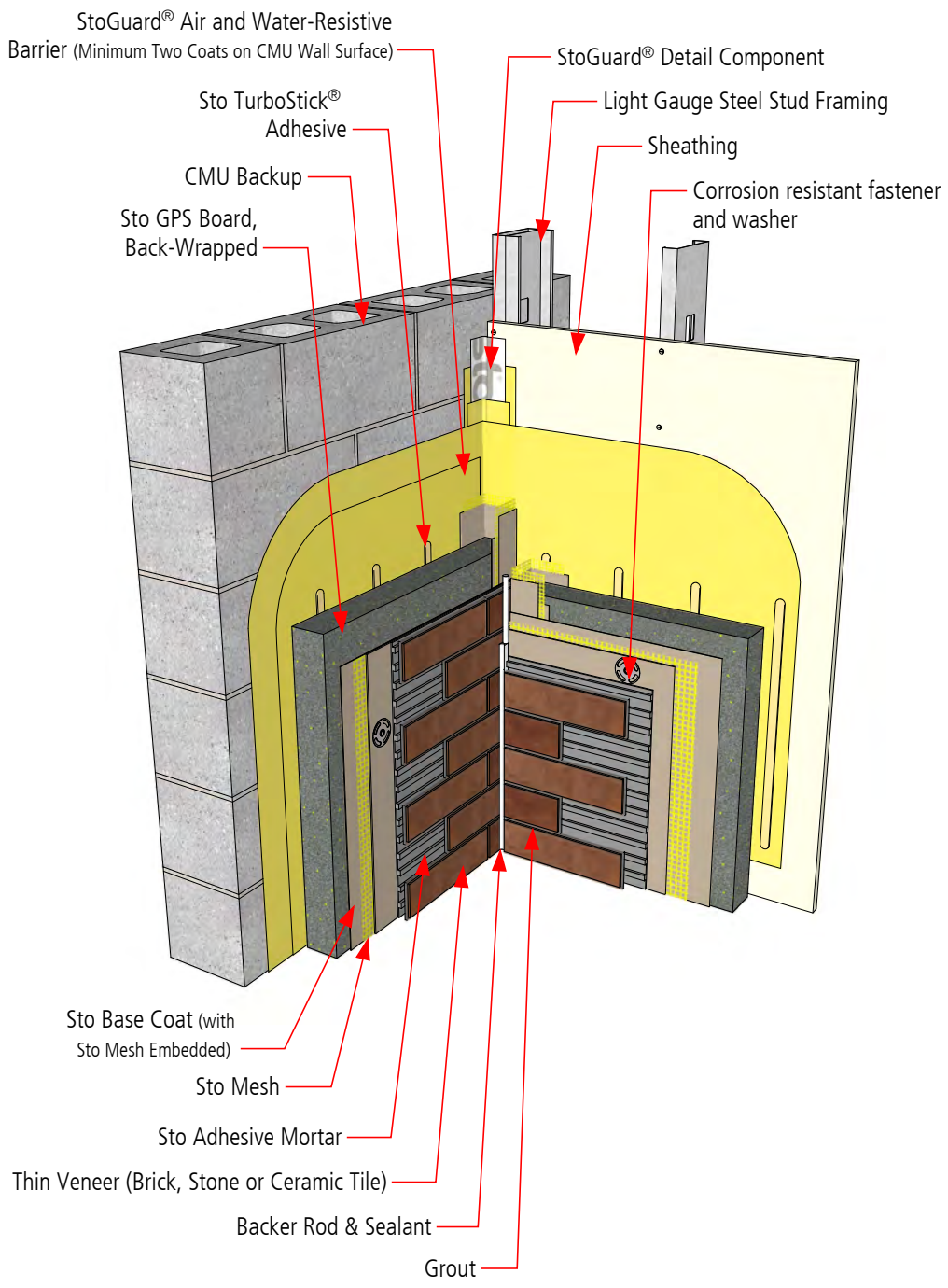
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Inside Corner with Dissimilar Backup Wall

Detail No.: 57s.53
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

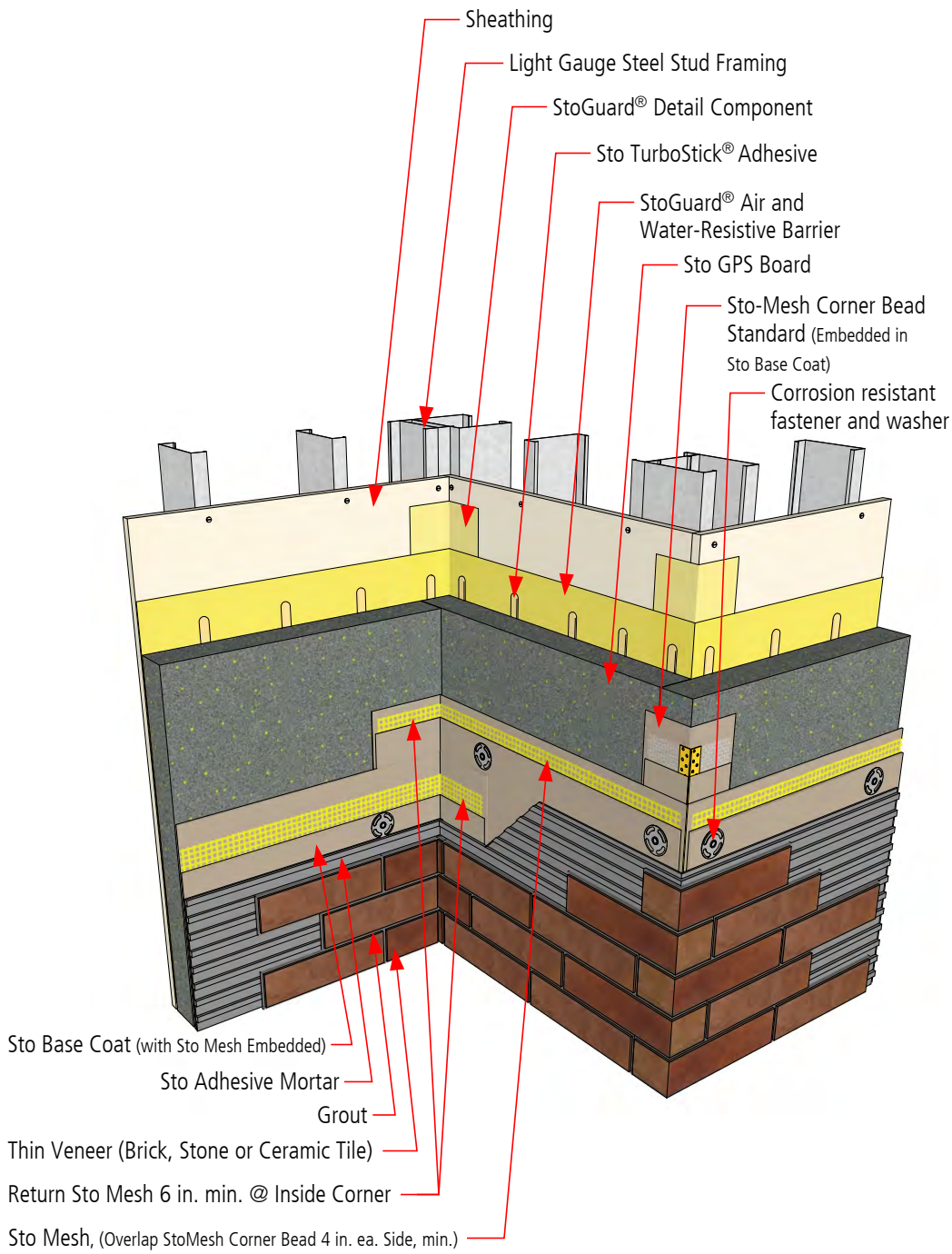
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Inside and Outside Corner with Common Substrate and StoMesh Corner Bead Reinforcement

Detail No.: 57s.54A
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

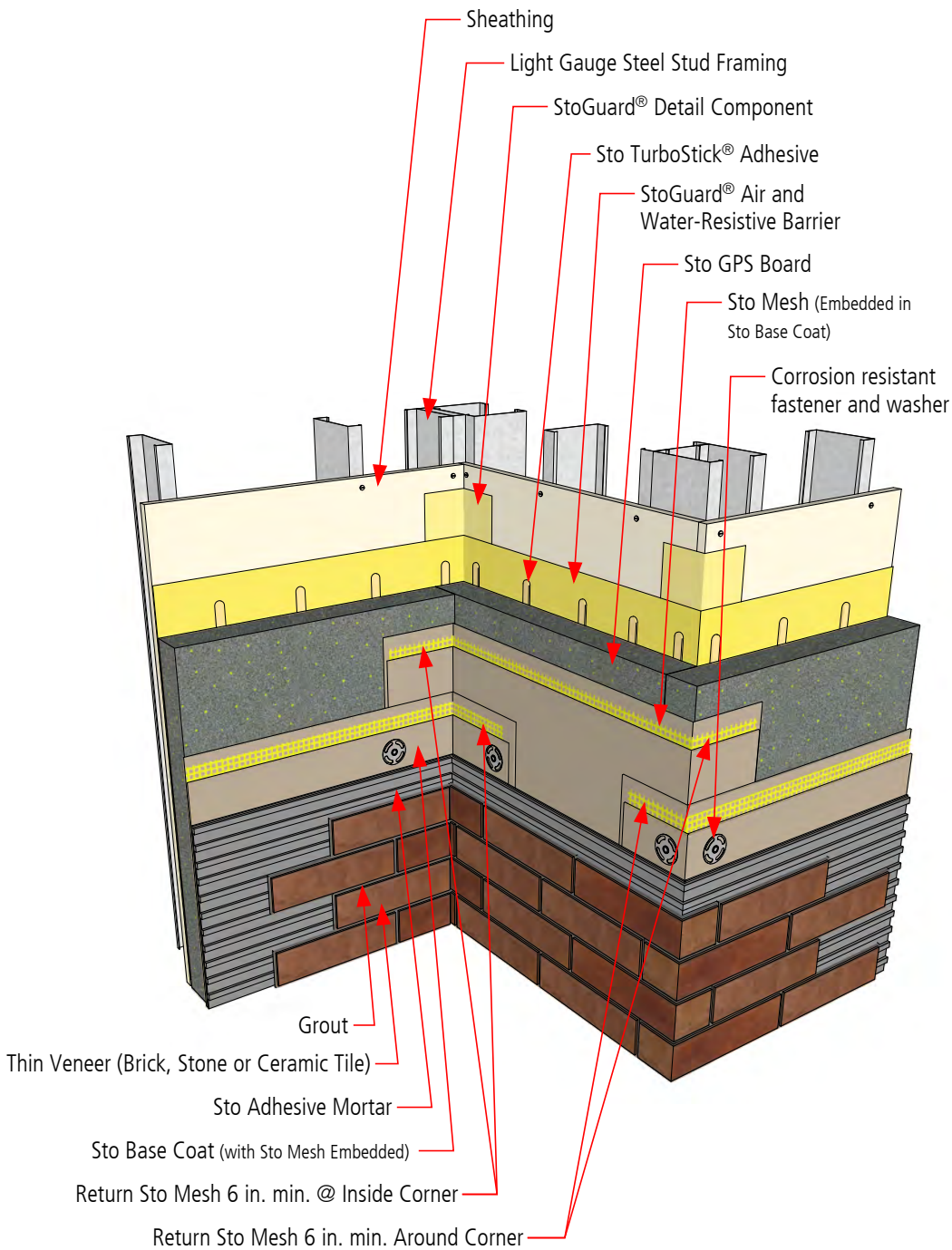
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Inside and Outside Corner with Common Substrate and Sto Mesh Reinforcement

Detail No.: 57s.54B
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

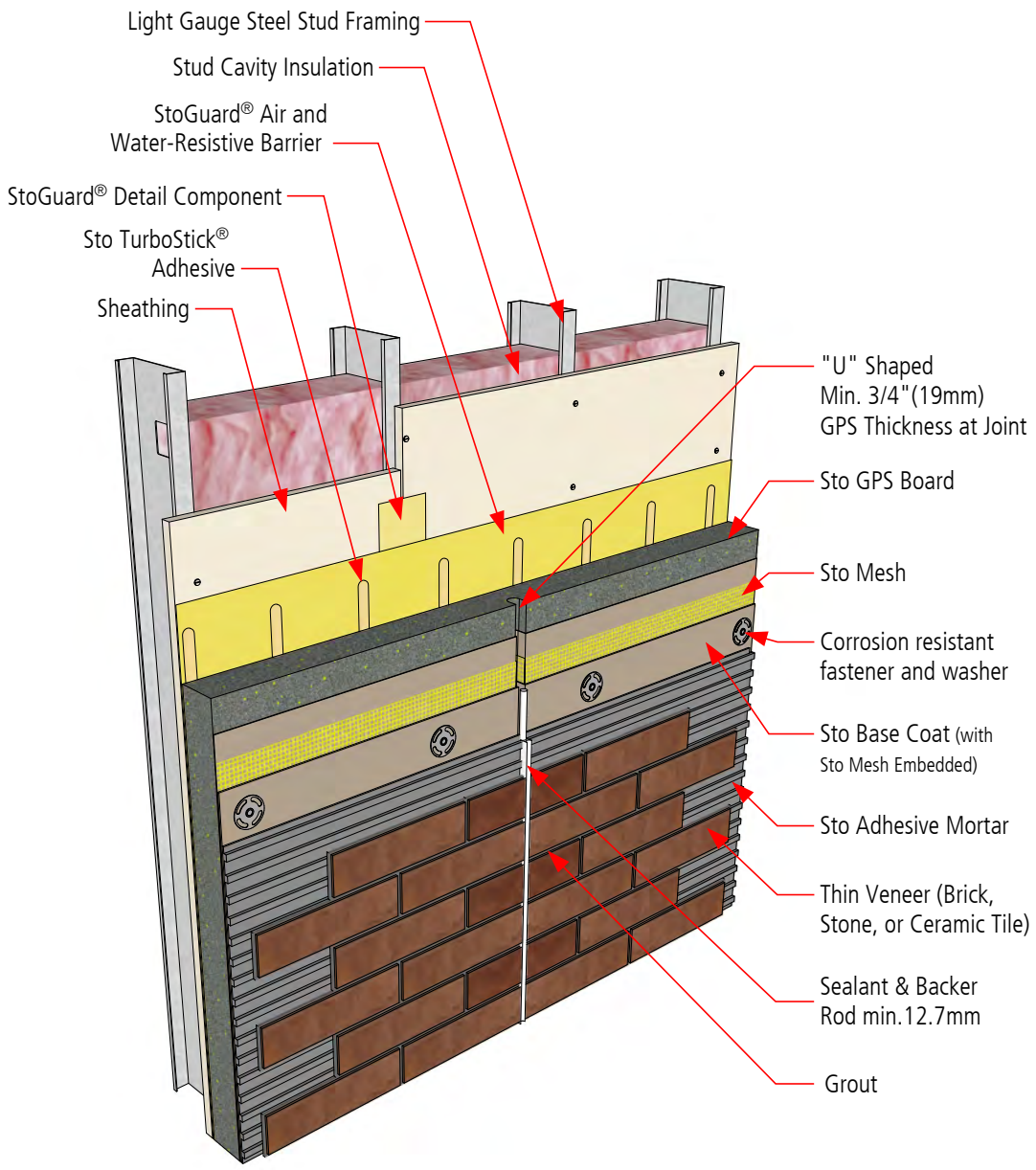
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Expansion Joint

Detail No.: 57s.55
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

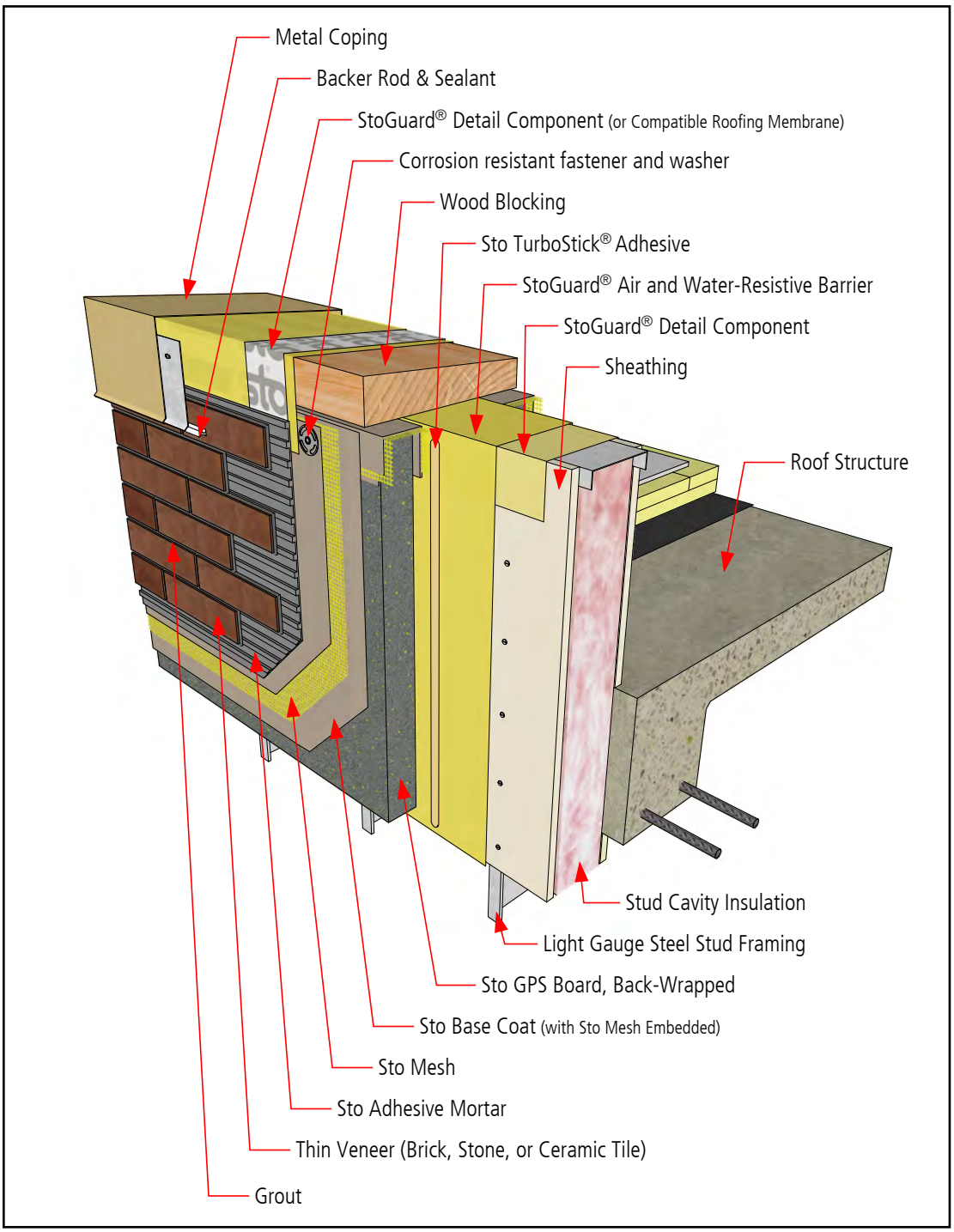
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Termination at Parapet - Front

Detail No.: 57s.60A
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

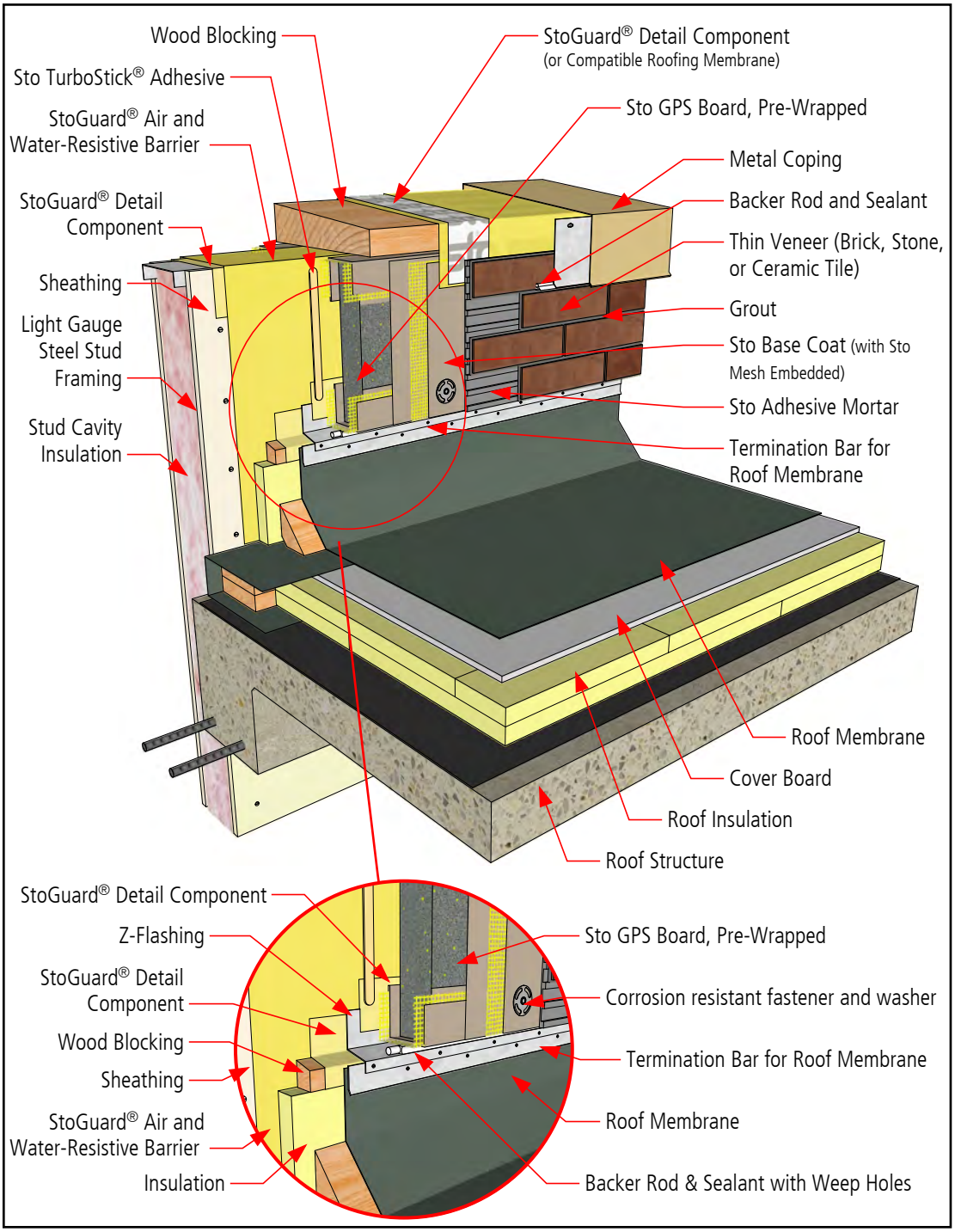
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Termination at Parapet - Back

Detail No.: 57s.60B
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

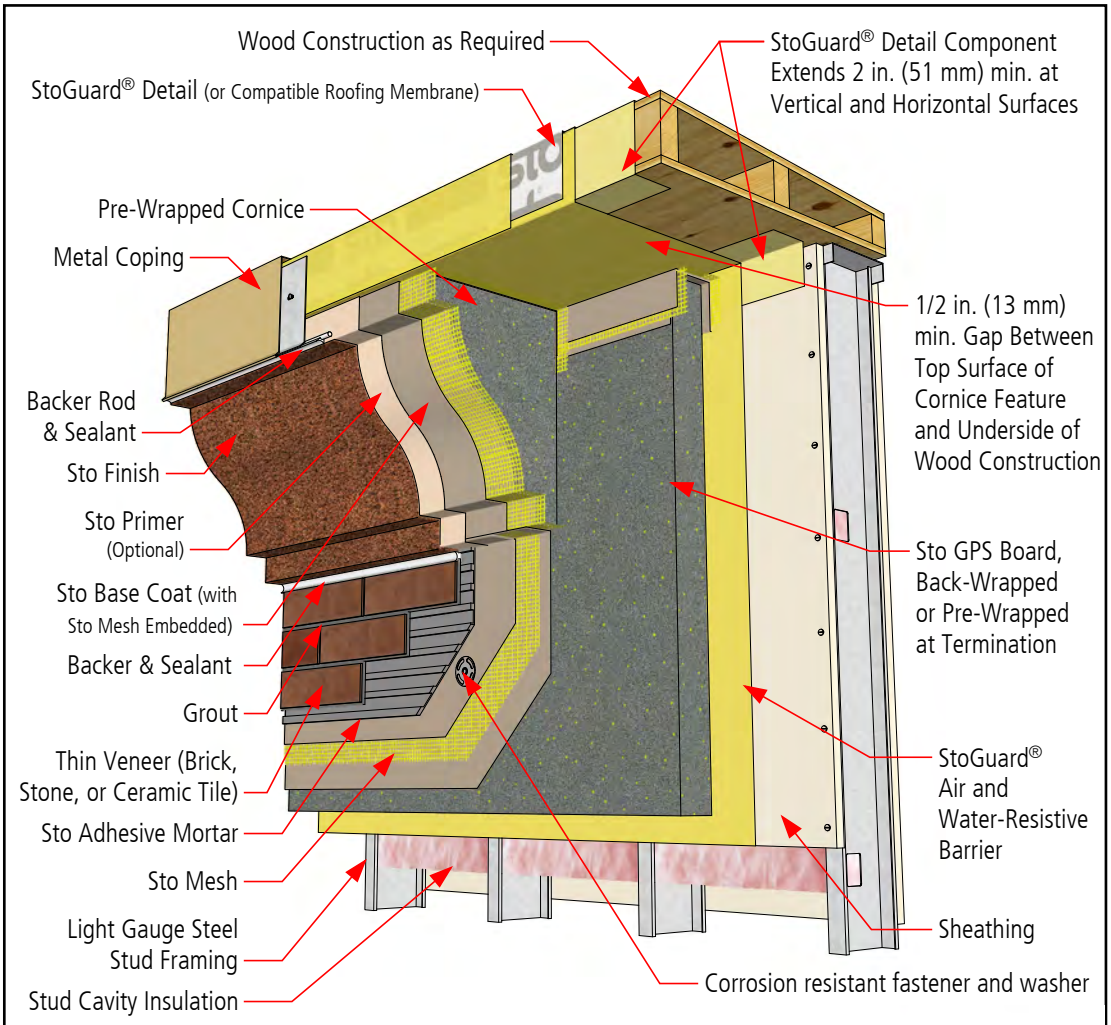
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

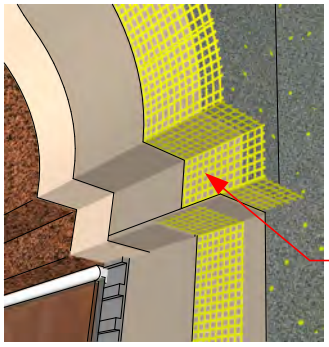
STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

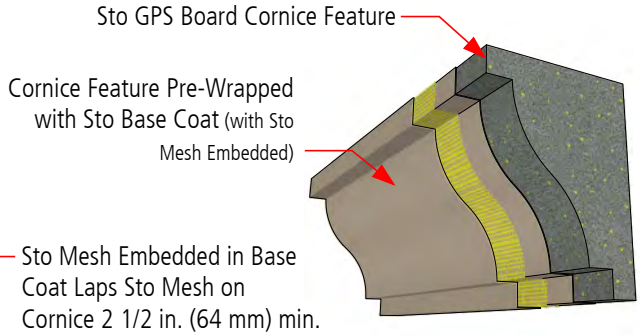
StoTherm® ci MVES
Parapet with Cornice Feature

Detail No.: 57s.61
Date: August 2023





View of Mesh Overlap



View of Pre-Wrapped Cornice

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

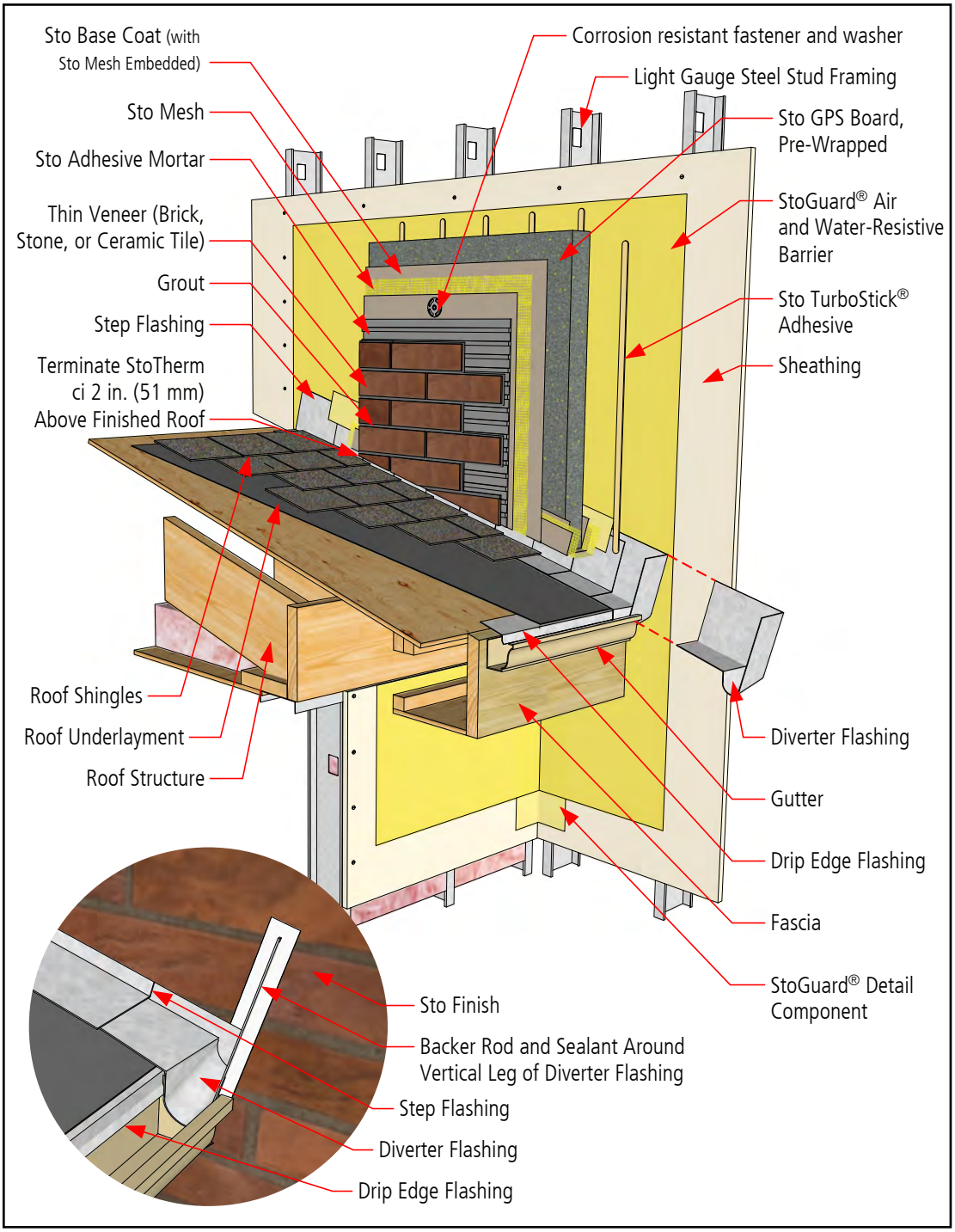
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Diverter Flashing at Roof/Wall Abutment

Detail No.: 57s.62
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

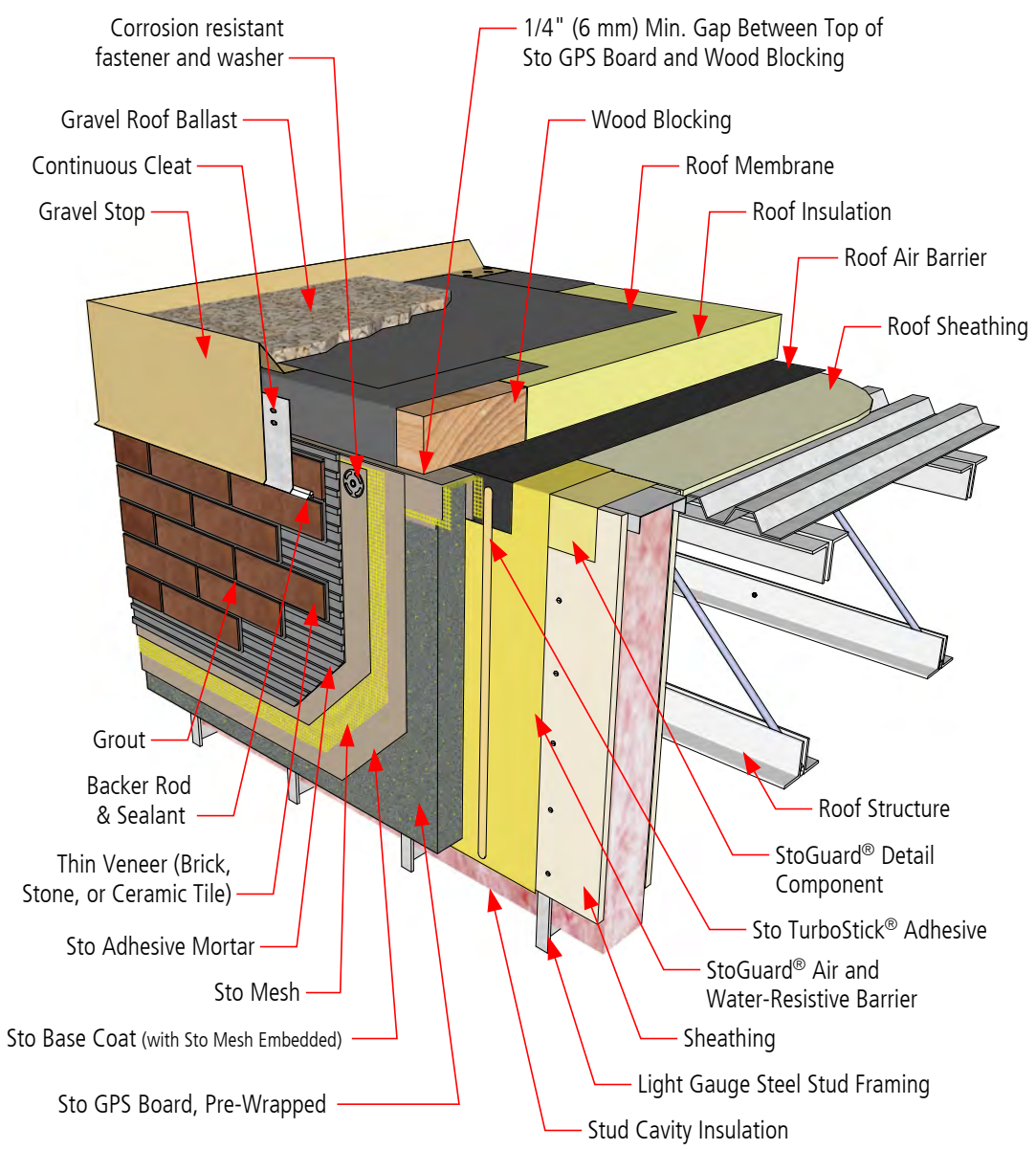
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Gravel Stop

Detail No.: 57s.63
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

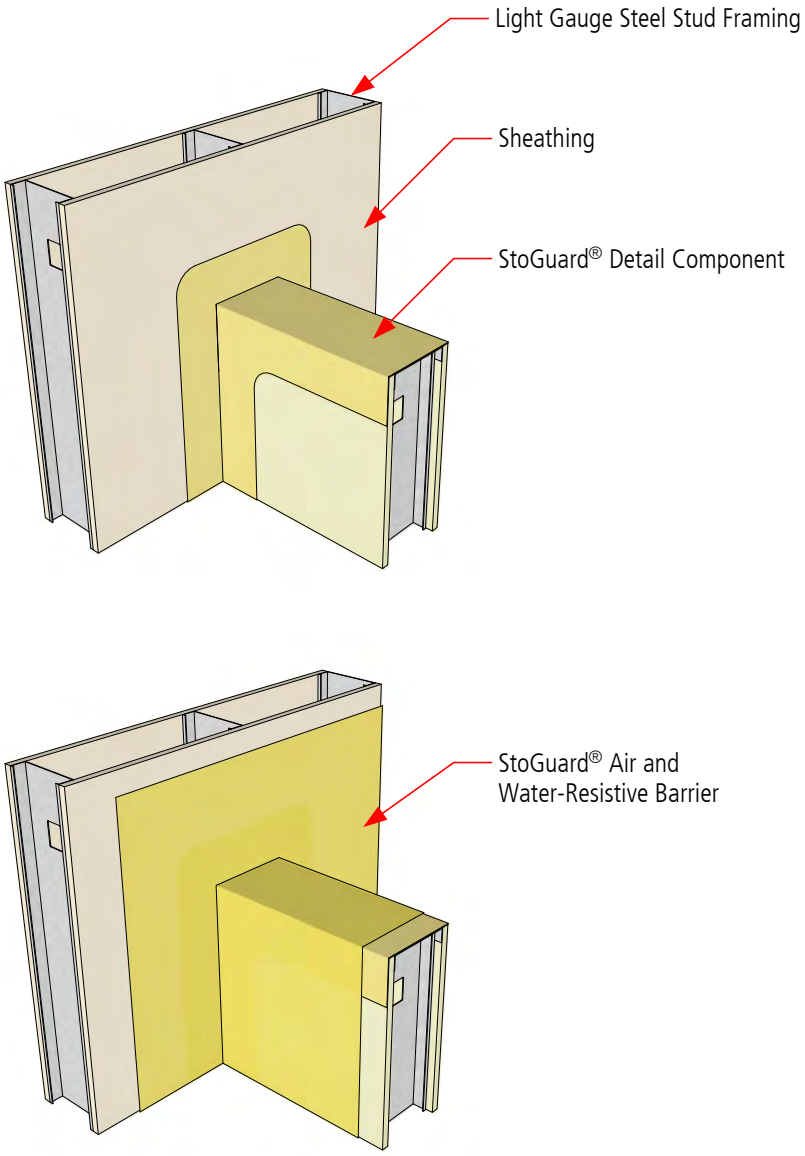
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Saddle Flashing at Lower/Higher Wall Abutment

Detail No.: 57s.64-1
Date: August 2023



Step 1 - Air and Moisture Barrier

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

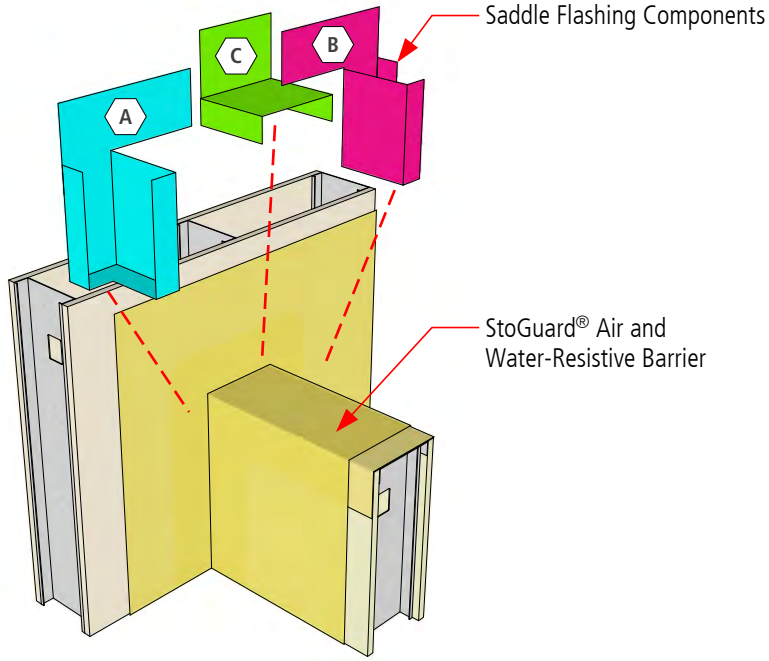
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

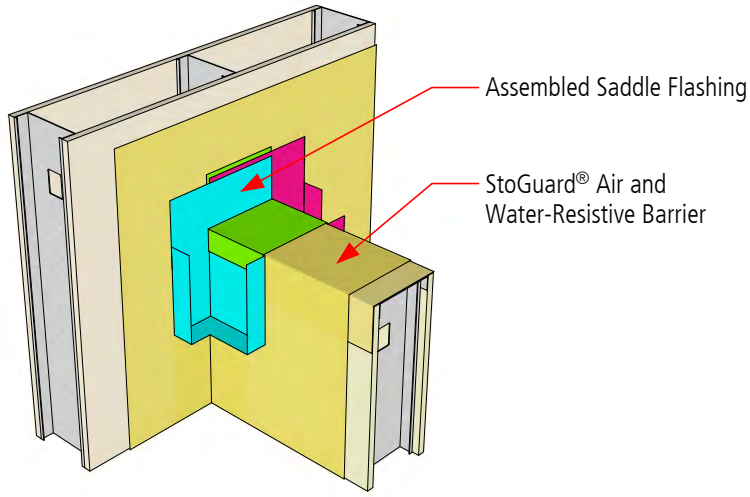
STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Saddle Flashing at Lower/Higher Wall Abutment

Detail No.: 57s.64-2
Date: August 2023





Step 2 - Saddle Flashing

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

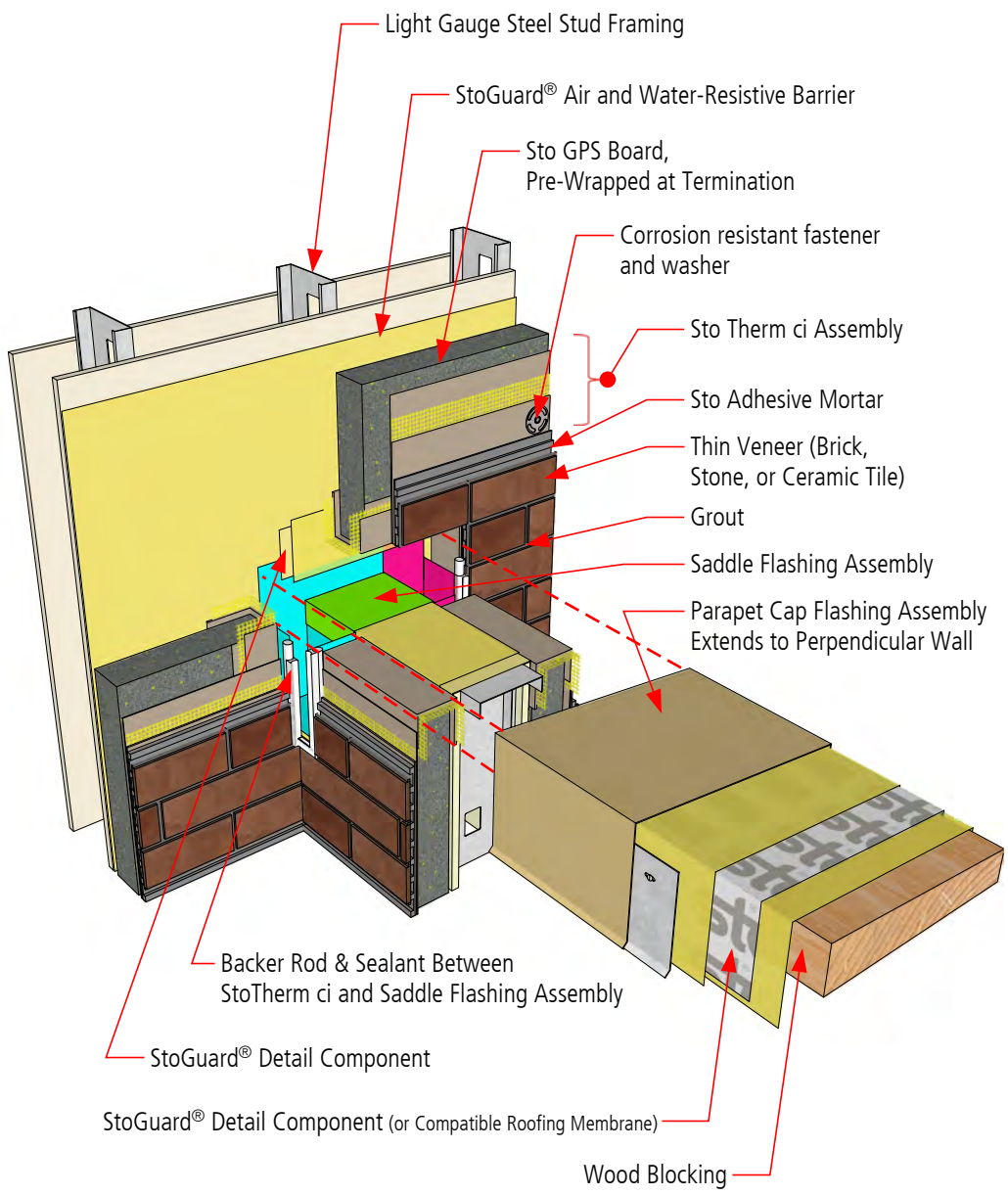
Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

www.stocorp.com

StoTherm® ci MVES
Saddle Flashing at Lower/Higher Wall Abutment

Detail No.: 57s.64-3
Date: August 2023



Step 3 - Cladding, Coping, and Sealant

Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

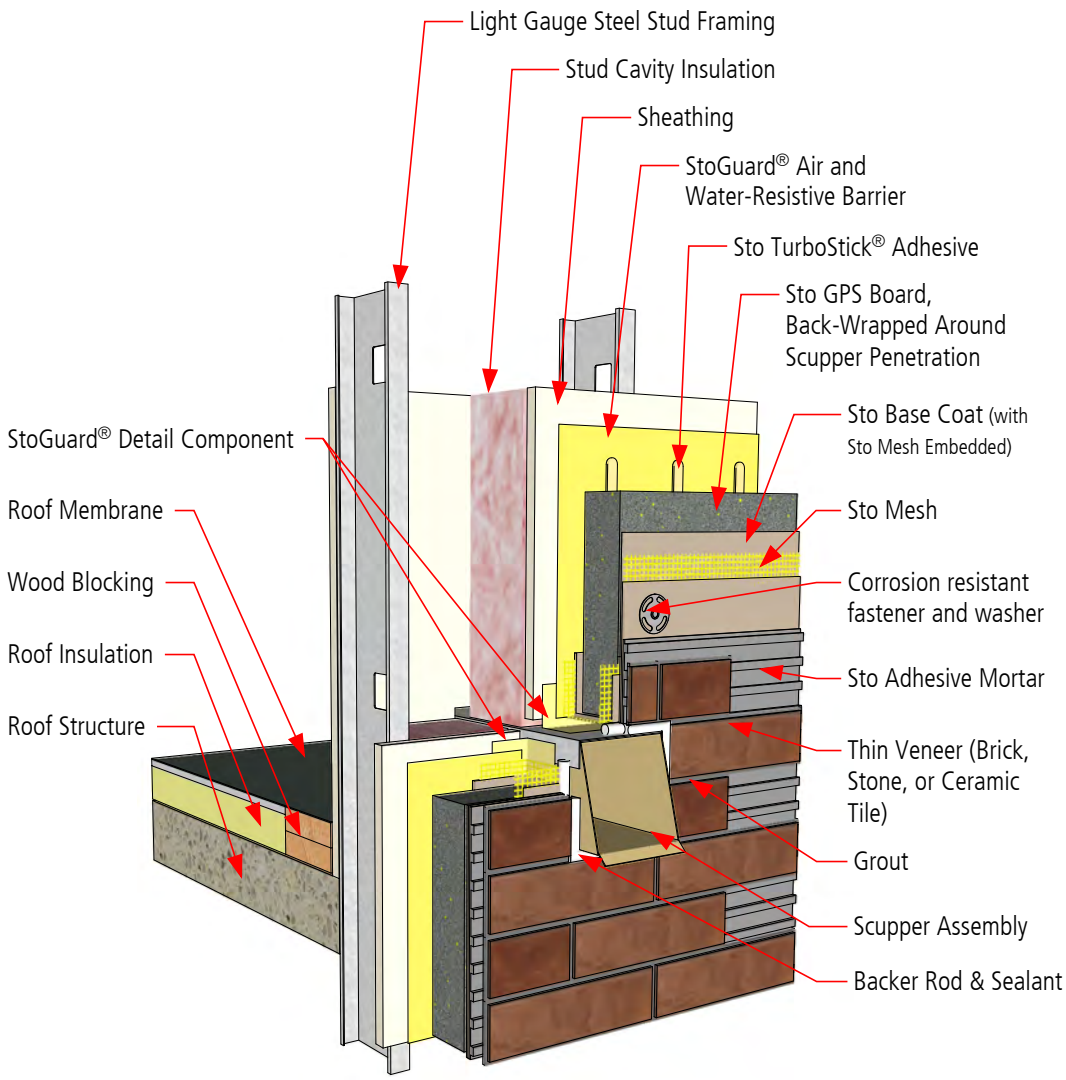
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Scupper Penetration

Detail No.: 57s.65
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

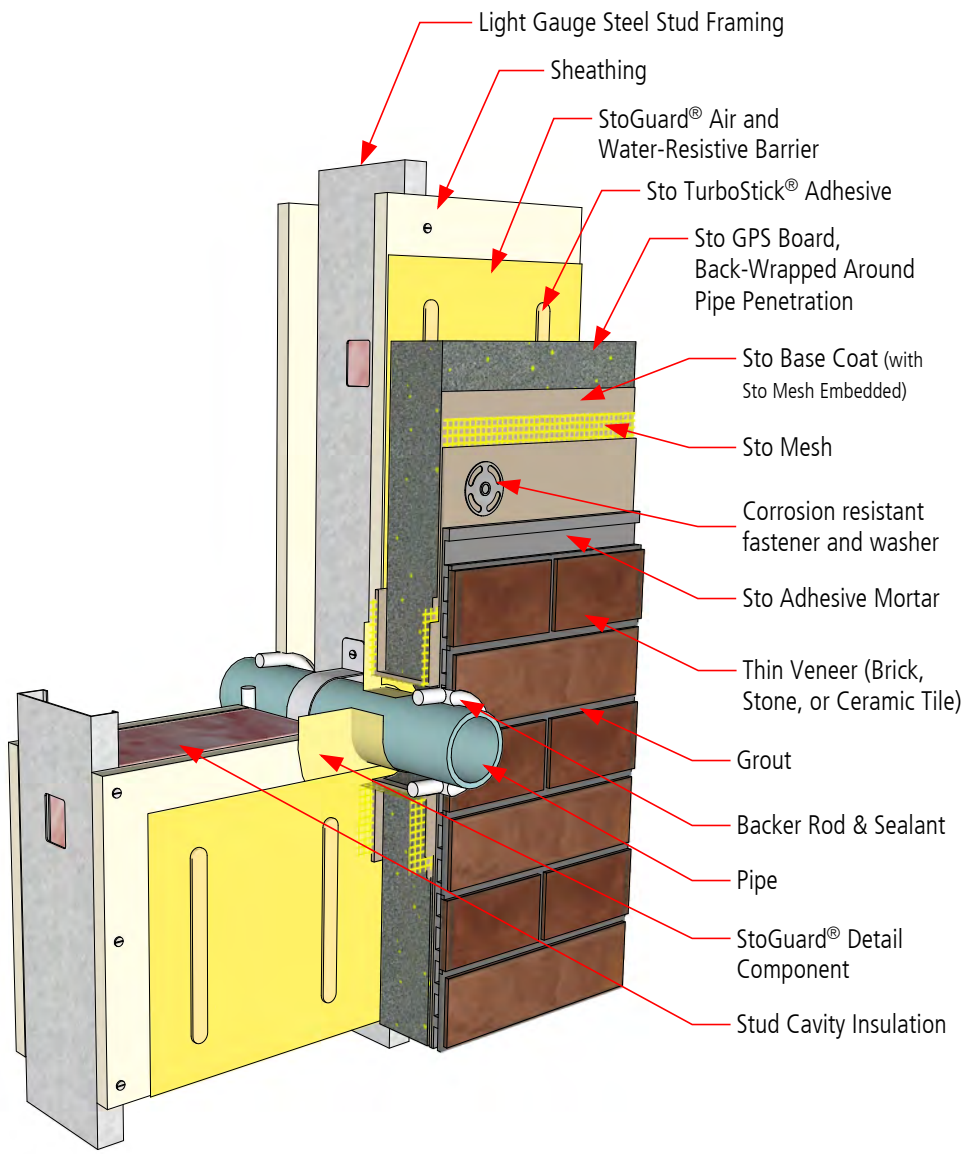
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Pipe Penetration - Precision Cut Sheathing

Detail No.: 57s.70A
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

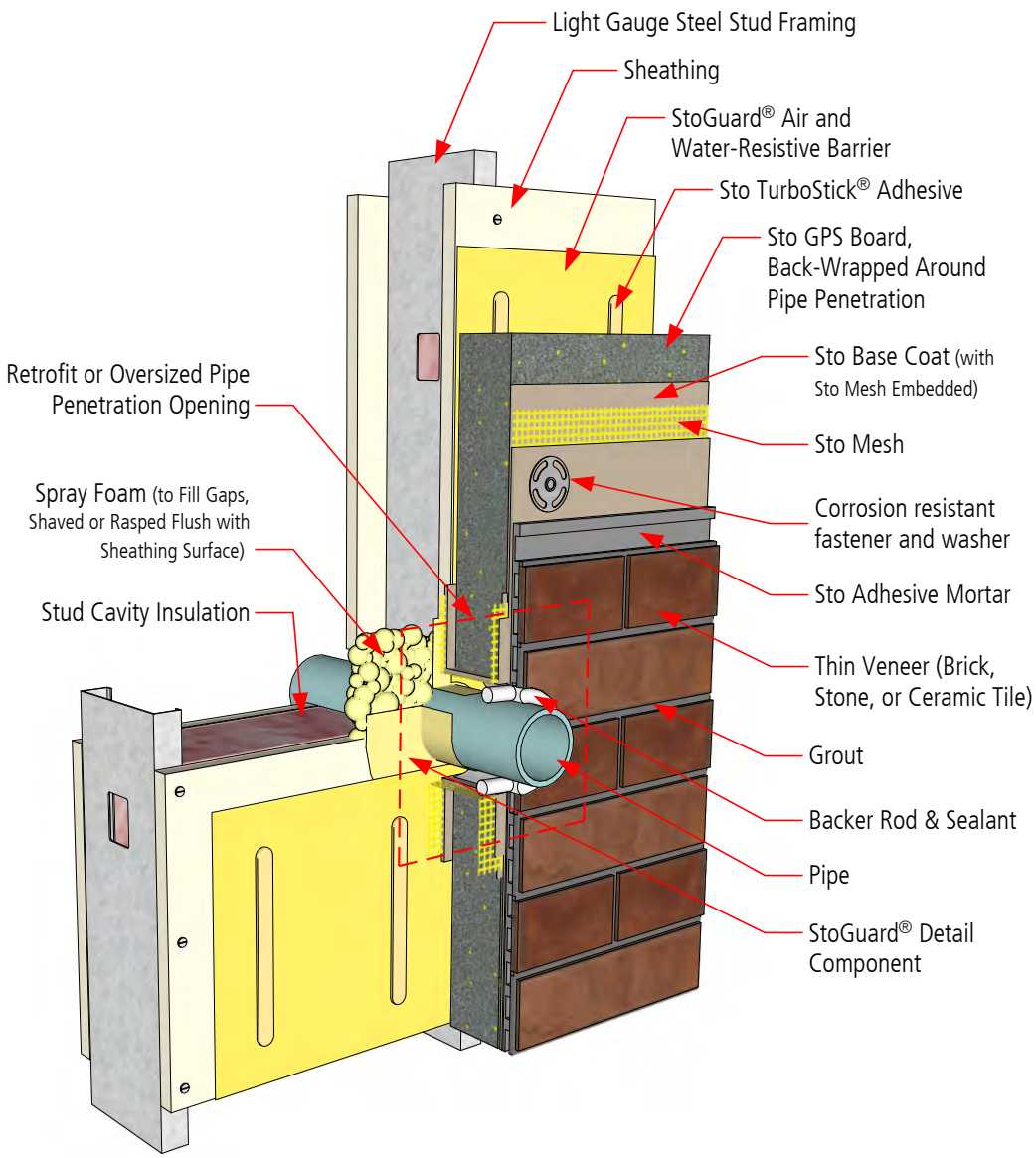
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Pipe Penetration - Rough Cut Sheathing

Detail No.: 57s.70B
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

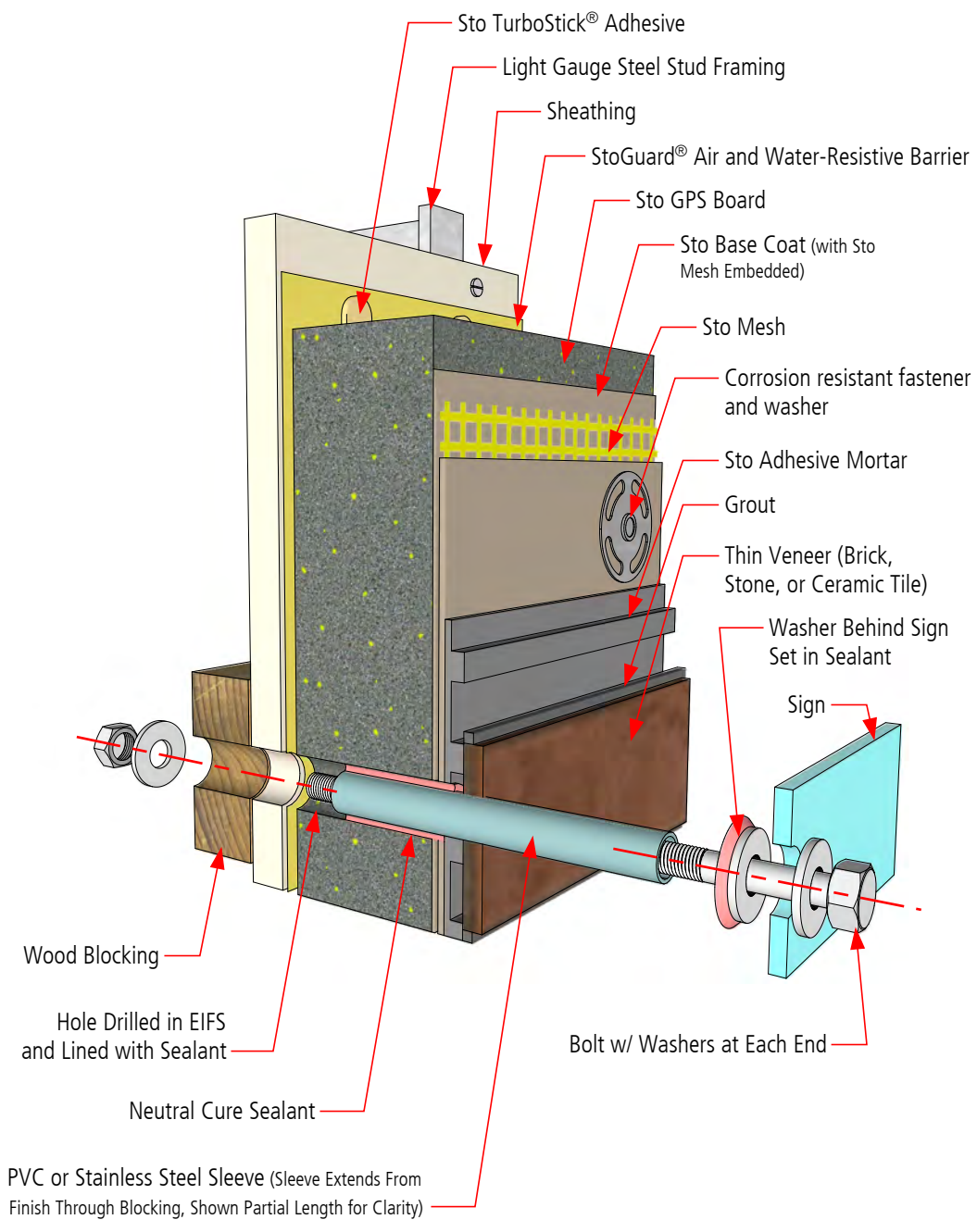
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Sign Attachment

Detail No.: 57s.71
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

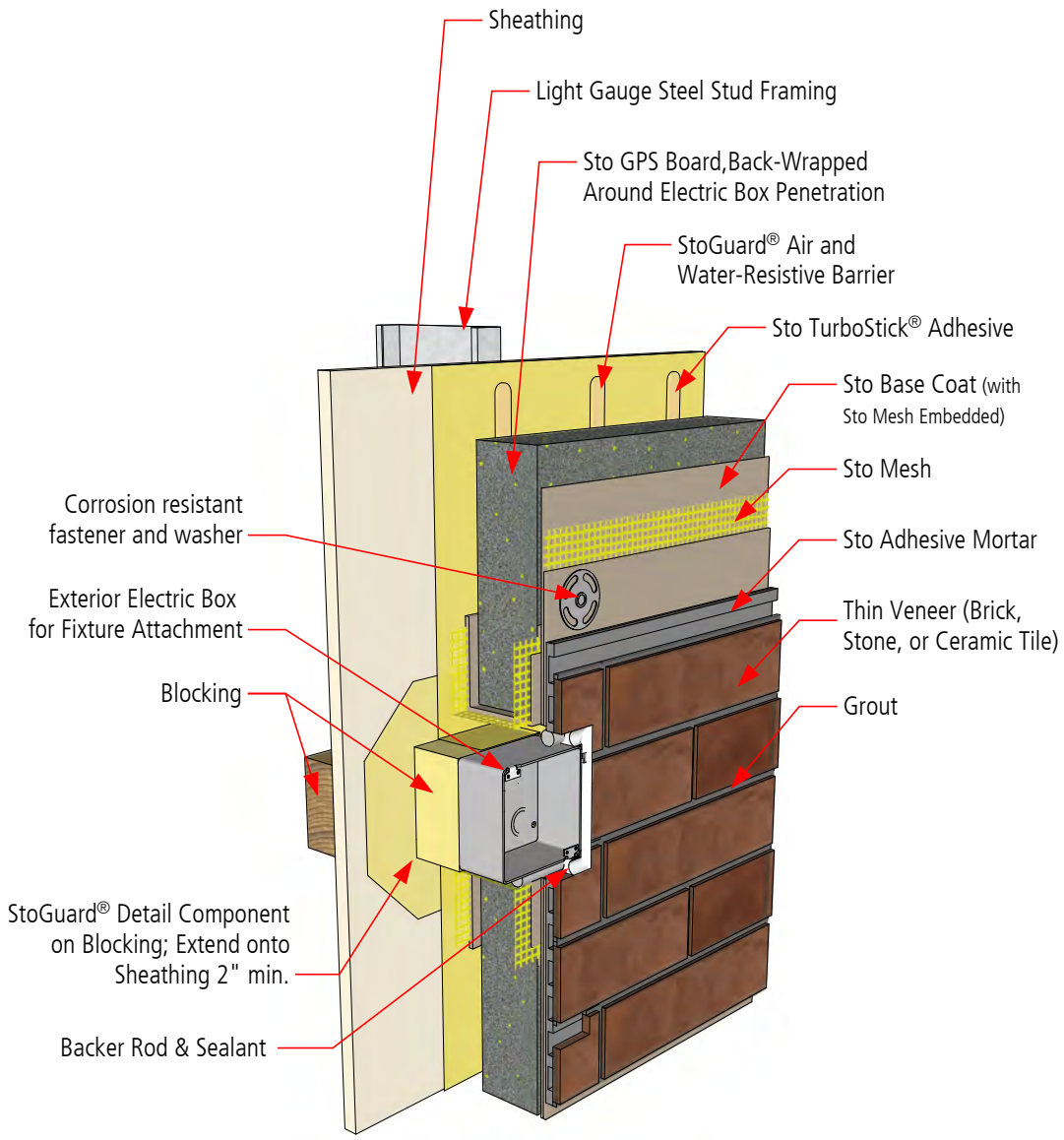
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Fixture Attachment

Detail No.: 57s.73
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

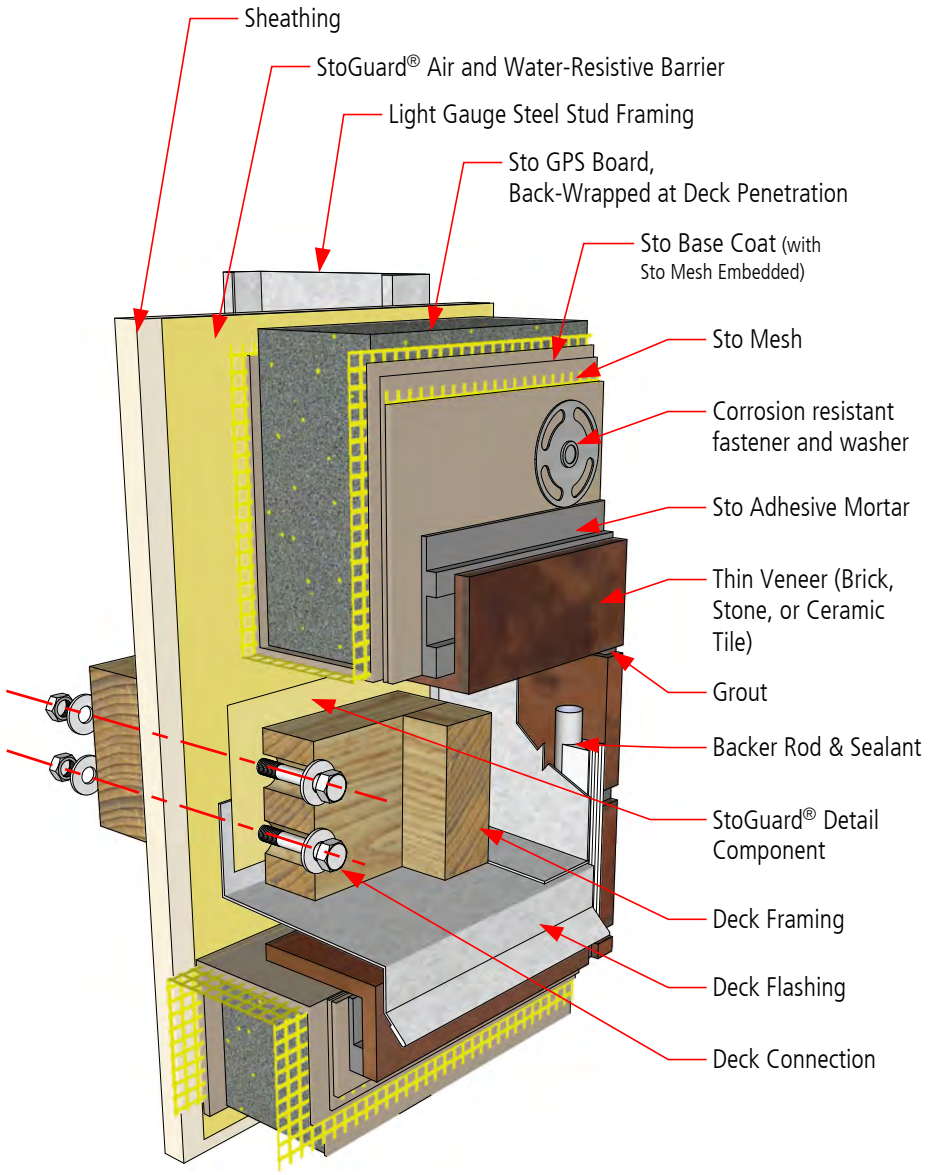
www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

StoTherm® ci MVES
Deck Connection over Steel Frame

Detail No.: 57s.74
Date: August 2023



Notes:

1. Refer to StoGuard Product Use Chart (Table 1.1) for StoGuard detail components; joint treatment, rough opening protection, backing for masonry anchors, or transitions to dissimilar materials, joints and seams in construction.

2. Refer to General Notes for specific information and design guidance on wall assembly components.

3. Components not identified as Sto are furnished by other manufacturers and are not necessarily installed by trades who install the Sto products. Refer to project specific contract documents.

ATTENTION

Property of Sto Corp. All Rights Reserved

www.stocorp.com

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, of for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components.

STO CORP. DISCLAIMS ALL WARRANTIES EXPRESSED OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STOS WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website. **www.stocorp.com**

SECTION 07 26 00

VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vapor barrier placed on soil surface.

B. Related Sections:
1. Section 03 11 00 - Concrete Forming and Accessories: Masonite topping sheet.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Vapor retarder at roof expansion joints.
3. Section 31 31 00 - Soil Treatment: Temporary polyethylene sheeting over treated soil.
4. **Section 01 91 19 Building Envelope Commissioning**

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Barrier: Product/manufacturer; one of the following: Ecoshield-E; Epro Services
Stego Wrap (15 mil) Vapor Barrier; Stego Industries, LLC
Perminator (15 mil); W.R. Meadows

B. Vapor Barrier membrane shall have the following qualities:
1. Permeance of less than 0.01 Perms [grains/(ft2*hr*inHg)] as tested after mandatory conditioning tests ASTM E 154 (sections 8, 11, 12, 13) per ASTM F 1249 or ASTM E 96.
2. ASTM E 1745 Class A.
3. Minimum thickness 15 mils.

C. Accessories:
1. Seam Tape: High-density polyethylene tape with pressure sensitive adhesive. Minimum width 4 inches.
2. Pipe Boots (Penetrations of Vapor Barrier): Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.
3. Perimeter/edge seal: Provide the following as manufactured by Stego Industries LLC, (887) 464-7834 www.stegoindustries.com.
   a. Stego Crete Claw
   b. Stego Term Bar.
   c. StegoTack Double-Sided Tape.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove soil treatment protective vapor barrier before placement of permanent vapor barrier.

B. Ensure that subsoil is approved by Architect and/or geotechnical engineer.

3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643.

B. Unroll vapor retarder with the longest dimension parallel with the direction of the concrete pour.

C. Overlap joints a minimum of 6" and seal with manufacturer's tape.

D. Seal all penetrations (including pipes) with manufacturer's pipe boot.

E. Turn edge of sheeting down face of perimeter grade beam a minimum of 6".

F. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6" and taping all four sides with tape.

3.3 **FIELD QUALITY CONTROL**

A. **Quality Assurance Inspections: Vapor retarder materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.**

END OF SECTION

SECTION 07 27 00

AIR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Weather-resistant air barrier. Bridge and seal the following air leakage pathways and gaps:
   1. Connections of the walls to the roof air barrier.
   2. Connections of the walls to the foundations.
   3. Seismic and expansion joints.
   4. Openings and penetrations of window and door frames, store front, curtain wall.
   5. Piping, conduit, duct and similar penetrations.
   6. Masonry ties, screws, bolts and similar penetrations.
   7. All other air leakage pathways in the building envelope.

B. **Related Sections:**
   1. **Section 01 91 19 - Building Envelope Commissioning**

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. **Shop Drawings: Require shop drawings for air barrier assemblies to include: Locations and extent of specific air barrier materials, project specific details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.**

PART 2 - PRODUCTS

2.1 MATERIALS

A. Weather-Resistant Air Barrier: Water-resistant barrier shall be fabricated of spunbonded olefin or multi- layer spunbonded polypropylene, nonwoven, non-perforated sheets in manufacturer's standard widths with the following performance characteristics:
   1. Provide one of the following acceptable manufacturers: Tyvek® CommercialWrap™; DuPont Co. WrapShield®; VaproShield LLC
   2. Air Retarder: ASTM E 1677 Type I, air leakage at 25 mph wind pressure of less than 0.06 cfm/ft.^{2}.
   3. Water Vapor Transmission of greater than 20 perms in accordance with ASTM E 96, Method B.
   4. Water penetration resistance of 200 cm minimum in accordance with AATCC-127.

B. Window Flashing: Provide manufacturer's self adhering flashing for a complete air barrier system. Dupont FlexWrap™ flashing system; Dupont Co. VaproFlashing™ SA ; VaproShield LLC

C. Sealing Tape: Provide manufacturer's sealing tape DuPont Contractor Tape; Dupont Co. Integrated Sealing Tape; VaproShield LLC

D. Fasteners: Manufacturer recommended screws with washers and caps.

2.2 **PERFORMANCE REQUIREMENTS**

A. **Installed building envelope air leakage shall be less than or equal to 0.40 cfm/ sf at 75 Pascals compliant with IECC 2015 requirements, tested under both pressurization and de-pressuization per ASTM E779.**

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations over exterior sheathing.

B. Seal joints and penetrations through weather-resistant barrier with sealing tape and fasteners with caps. Air infiltration barrier shall be air-tight and free from holes, tears, and punctures.

C. All window and door penetrations shall be taped per manufacturer's instructions.

3.2 PROTECTION

A. Remove and replace water-resistive vapor permeable air barrier affected by chemical spills or surfactants.

3.3 **FIELD QUALITY CONTROL**

A. **Testing Agency: Engage a qualified testing agency to perform functional performance tests and evaluation of air barrier installation per ASTM E1186.**

B. **Quality Assurance Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists.**

C. **General Contractor shall provide QA/QC personnel to implement construction checklists according to approved Quality Assurance Program schedule.**

END OF SECTION

SECTION 074200

ALUMINUM COMPOSITE MATERIAL BUILDING PANELS (PE)

Part 1 – GENERAL

1.01 Summary

A. Section Includes

1. The extent of panel system work is indicated on the drawings and in these specifications.
2. Panel system requirements include the following components:

a. Aluminum-faced composite panels with mounting system. Panel mounting system including anchorages, furring, fasteners, gaskets and sealants, related flashing adapters and masking for a complete installation.
b. Panel manufacturer recommends that system should include shop-installed aluminum stiffeners on all panels of 20 square feet or larger. Minimum stiffener recommendation is one per 20 square feet of panel area.
c. Parapet coping, column covers, soffits, sills, border and filler items may be indicated as integral components of the panels system or as designed.
d. All flashing metal required shall be provided by the panel manufacturer.
e. System to be fabricated and installed per local code requirements.

B. Related Documents

1. Drawings and general provisions of the contract, including general and supplementary conditions, division 1 specification sections and technical specification divisions 2 through 33, apply to this section.

C. Related Work Specified Elsewhere

1. Section 051200: Structural steel
2. Section 072100: Insulation
3. Section 076200: Metal flashing, counter flashing and parapet coping
4. Section 079200: Caulking and sealants
5. Section 099123: Interior wall finishes

1.02 Performance Requirements

A. Structural performance: provide exterior/interior wall cladding assemblies capable of withstanding the effects of load and stresses from dead loads, wind loads, snow loads and normal thermal movement without evidence of permanent defects of assemblies or components.
1. Dead load: As required by applicable building code.
2. Live Load: As required by applicable building code.
3. Wind Load: Uniform pressure of 45 lb/sq ft., acting inward or outward.
4. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum changes (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:
a. Temperature Change (range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Sealed joints shall allow free and silent movement of panels during expansion and contraction while preventing uncontrolled penetration of moisture.

C. Manufacturing, installation, and sealing shall prevent deformation of exposed surfaces.

D. Design panel system to accommodate substructure tolerance of +0 to -1/8 inch.

E. Design the system to affect a positive mechanically fastened assembly to substructure, not dependent on adhesives.
F. Not Permitted: Vibration harmonics; wind whistles; noises caused by thermal movement; thermal movement transmitted to other building elements; loosening, weakening or fracturing of attachments or components of system.
G. Structural Performance / Uniform Load Deflection Test: Provide panel system that has been tested in accordance with ASTM E330 at a design pressure of 60 psf without deformation or failures of structural members. Maximum allowable deflection of span: L/60.
H. Air Infiltration: Panel system shall not have air infiltration rate more than 0.06 cfm per sq. ft. of fixed wall area when tested in accordance with ASTM E283 at static air pressure differential of 1.57 psf.
I. Static Water Penetration: Panel system shall have no water penetration as defined by in test method when tested in accordance with ASTM E331 at inward static pressure differential of not less than 6.24 psf and not more than 12.0 psf.
J. Dynamic Water Penetration: Panel system shall have been tested in accordance with AAMA 501 and shall have passed with no uncontrolled water leakage at 10.00 psf dynamic pressure differential, with water application rate of 5 gallons/hr/sqft.

1.02 Quality Assurance

A. Composite panel manufacturer shall have a minimum of 5 years' architectural experience in the manufacture of this product and be located within the continental USA.
B. It is recommended that fabrication and installation of composite panels shall be from a single source. If not single source, both panel fabricator and the installer must show proof of past successful collaboration.
C. Installer shall be acceptable to composite panel manufacturer.
D. Installer shall have a minimum 5 years' experience in architectural metal panel work similar in scope and size to this project.
E. Coordinate fabrication schedule with construction progress as directed by the contractor to avoid delay of work.
F. Shop drawings shall show the preferred joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration, on the inside face of the panel system as determined by ASTM E331.
G. Maximum deviation from vertical and horizontal alignment of erected panels: 6 mm (1/4") in 6 m (20') non-accumulative.
H. Panel fabricator and installer shall assume undivided responsibility for all components of the exterior panel system, including but not limited to, attachment to sub-construction, panel-to-panel joinery, panel-to-dissimilar-material joinery and joint seal associated with the panel system.

1.03 References

A. American Society for Testing and Materials
   1. E330: Structural Performance of Exterior Windows, Curtain Walls and Doors under the Influence of Wind Loads.
   2. E283: Rate of Leakage Through Exterior Windows, Curtain Walls and Doors.
   3. D1781: Climbing Drum Peel Test for Adhesive Materials.
   4. E84: Surface-Burning Characteristics of Building Materials.
   5. E283: Air Performance of Exterior Windows, Curtain Walls and Doors.
   6. D3363: Method for Film Hardness by Pencil Test.
   7. D2794: Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
   8. D3359: Methods for Measuring Adhesion by Tape Test.

9. D2247: Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
10. B117: Method of Salt Spray (Fog) Testing.
11. D822: Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer and Related Products.
12. D1308: Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
13. D1735: Method for Water Fog Testing of Organic Coatings.
14. D1929: Standard Test Method for Determining Ignition Temperature of Plastics.
15. D635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in Horizontal Position.

B. American Architectural Manufacturers Association

1. AAMA-620

1.04 Submittals

A. Submittals shall be in conformance with section 01 33 23.

B. Samples

1. Panel assembly: Two samples of each type of assembly, 304 mm (12”) x 304 mm (12”) minimum.
2. Two samples of each color or finish selected, 76 mm (3") x 102 mm (4") minimum.
3. Custom-color samples will contain drawdown lines. Sizes for custom-color samples are limited.

C. Shop Drawings: Submit shop drawings showing project layout and elevations; fastening and anchoring methods; detail and location of joints, sealants and gaskets, including joints necessary to accommodate thermal movement; trim; flashing; and accessories.

D. Manufacturer’s literature shall certify that material meets specifications.

E. Submit fabrication drawings showing location and type of aluminum-extruded stiffeners at typical panels and at corner panels, if required.

F. Documents showing product compliance with the local building code shall be submitted prior to the bid. These documents may include evaluation reports, test reports, supporting document and drawings, and manufacturer’s data. The architect must approve alternate material prior to bid date.

1.05 Delivery, Storage & Handling

A. General: Comply with Division 1 Product Requirements Sections.

B. Ordering: Comply with manufacturer’s ordering instructions, and lead-time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

1. Store materials in accordance with manufacturer’s recommendations.
2. Handle materials carefully to avoid damage to materials and finishes.

1.06 Project Conditions

A. Field Measurements: Verify actual supporting and adjoining construction by field measurements before fabrication, and indicate recorded measurements on final shop drawings. Coordinate construction to ensure that wall panel assemblies fit properly to supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the work.

1. Established dimensions: where field measurements can not be made without delaying the work, guarantee dimensions and proceed with fabrication of wall panel assemblies corresponding to the established dimensions.

1.07 Warranty

A. The installer will warrant the wall system for a period of 1 year that the fabrication and installation workmanship will be free from defects.

B. The aluminum composite material manufacturer shall warrant for a period of 20 years against Max 5 fade based on ASTM D2244 and Max 8 chalk based on ASTM D4212 and delamination of the paint finish.

Part 2 – Products

2.01 Manufacturer

A. Manufacturers: Subject to compliance requirements, provide products manufactured by:
   1. Petersen Aluminum Corporation, 1005 Tonne Road, Elk Grove Village, IL 60007. Phone – 800-722-7440, Fax: 800-722-7150, www.pac-clad.com
      a. PAC 3000 RS Dry Joint Composite Wall Panel System
      b. PAC 3000 RS Rain Screen (Dry System) Composite Wall Panel System
      c. Alternate systems by other manufacturers/fabricators are to be submitted to the architect not less than 7 working days prior to bid.

2.02 Materials

A. Composite Panels

   1. Panels shall be Reynobond® Aluminum Composite Material (ACM) as manufactured by Alcoa Architectural Products, Other manufacturers are acceptable as long as they meet the same criteria as Reynobond in thickness, panel weight, bond integrity, fire rating, paint color and finish. ACM must be manufactured in the USA.
   2. Standard Fire rated Core (FR)
   3. Panel Thickness: RB160FR (4 mm) = 0.157"
   4. Panel Weight: RB160FR (4 mm) = 1.53 lbs/sft

B. Product Performance

   1. Bond integrity: When tested for bond integrity, in accordance with ASTM D1781 (simulating resistance to panel delamination), there shall not be an adhesive failure of the bond a) between the core and the skin or b) cohesive failure of the core itself below the following values.
   2. Peel Strength: 178 N mm/mm (40 in lb./in.) as manufactured; 178 N mm/mm (40 in lb./in.) After 21 days soaking in water at 70°F
   3. Fire Performance: ASTM E84 – Passed Class A; NFPA 285 - Passed

C. Panel Finishes
   1. Coil-coated Kynar 500® or Hylar 5000® based polyvinylidene fluoride (PVDF). Alcoa Architectural Products shall be Colorweld® 300 a fluoropolymer coating utilizing 70% Kynar 500® resins.
      a. Color: To be chosen from Alcoa Architectural Products, Reynobond® standard series one, two or three colors.
      b. Coating: Shall be factory applied on a continuous-process paint line. Coating shall consist of a 0.2 mil (approx.) prime coat and a 0.8 mil (approx.) finish coat containing 70% Kynar 500® resins. (If Colorweld® 300XL, coating shall consist of a 0.2 mil (approx.) barrier prime coat, a 0.80 mil (approx.) color coat, containing 70% Kynar

500® resins and a 0.5 mil (approx.) clear coat containing 70% Kynar 500® resins.) Nominal dry film thickness is 1.50 mils.

c. Specular Gloss: ASTM D523 standard at 60º shall be 15-35, Mica; 25–35 Metallic.
d. Pencil hardness: ASTM D3363 shall be F-2H minimum.
e. Flexibility T-Bend: ASTM D4145 shall be 1T to 2T-Bend; no pick-off.
f. Adhesion: ASTM D3359 reverse impact 1/16" crosshatch shall show no cracking or adhesion loss.
g. Reverse Impact: ASTM D2794 - Passes.
h. Salt Spray Resistance: ASTM B117, 5% salt fog at 95°F. Pass 4,000 hrs. less than 1/16" average creep from scribe; up to a few #8 blisters.
i. Humidity Resistance: ASTM ASTM D2247 100% relative humidity at 95ºF, shall pass 4,000 hrs., # 8 blisters.
j. Exterior Exposure: 10 years at 45º, South Florida. ASTM D2244 shall be 10 years, Max. 5 fade; and ASTM D4214 shall be Max. 8 chalk.
k. Paint system shall meet the requirements of AAMA 620 specifications. Megaflon®, Coraflon® or any Lumiflon®-based paint systems are not acceptable.
l. Paint system shall have more than 20 years of architectural field use.

2.03 Panel Fabrication

A. ACM is comprised of two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process using no glues or adhesives between dissimilar materials. The core shall be free of voids and/or air spaces and not contain foamed insulation materials. The bond between the core and the skins shall be a chemical bond. Products laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable.

B. Aluminum Face Sheets

1. Thickness: 0.020"
2. Aluminum alloy shall be 3000 series or equivalent.

C. Tolerances

1. Panel Bow: Shall not exceed 0.8% of panel overall dimension in width or length.
2. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions when possible. Panel dimensions shall be such that there will be an allowance for field adjustment and thermal movement.
3. Panel Lines: Breaks and curves shall be sharp and true, and surfaces free of warps or buckles.
4. Flatness: Panels shall be visually flat.
5. Panel Surfaces: Shall be free of scratches or marks caused during fabrication.

D. System Characteristics

1. Plans, elevations, details, characteristics and other requirements indicated are based upon standards by one manufacturer. It is intended that other manufacturers, receiving prior approval, may be acceptable, provided their details and characteristics comply with size and profile requirements, and material/performance standards.
2. System must not generally have any visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.
3. Fabricate panel system to dimension, size and profile indicated on the drawings based on a design temperature of 68ºF (20ºC).
4. Fabricate panel system to avoid compressive skin stresses. The installation detailing shall be such that the panels remain flat regardless of temperature changes and at all times remain air- and watertight.
5. The finish side of the panel shall have a removable protective film applied prior to fabrication, which shall remain on the panel during fabrication, shipping and erection to

protect the surface from damage.

E. System Type (*select from the following)*

1. PAC 3000RS - Rout-and-Return Dry System, engineered system including extruded perimeter frame, all extrusions, clips, trim and flashings.

F. System Performance

1. Composite panels shall be capable of withstanding building movements and weather exposures based on the following test standards required by the architect and/or local building codes:

a. Wind Load – If system tests are not available, under the direction of an independent third-party laboratory, mockups shall be constructed and tests performed to show compliance to the following minimum standards:

i. Panels shall be designed to withstand the design wind load based upon the local building code, but in no case less than 20 pounds per square foot (psf) and 30 psf on parapet and corner panels. Wind-load testing shall be conducted in accordance with ASTM E330 to obtain the following results.

ii. Normal to the plane of the wall between supports, deflection of the secured perimeter-framing members shall not exceed L/175 or 3/4", whichever is less.

iii. Normal to the plane of the wall, the maximum panel deflection shall not exceed L/60 of the full span.

iv. Maximum anchor deflection shall not exceed 1/16". At 1 1/2 times design pressure, permanent deflections of framing members shall not exceed l/100 of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16".

b. Air/Water System Test – Without backup waterproof membrane. If system tests are not available, under the direction of an independent third-party laboratory, mockups shall be constructed and tests performed to show compliance to the following minimum standards:

i. Air Infiltration – When tested in accordance with ASTM E283, air infiltration at 1.57 psf must not exceed 0.06 cubic feet per minute per square foot of wall area.

ii. Water Infiltration – Water infiltration is defined as uncontrolled water leakage through the exterior face of the assembly. Systems not using a construction sealant at the panel joints (i.e., Dry Systems) shall be designed to drain any water leakage occurring at the joints. No water infiltration shall occur in any system under a differential static pressure of 6.24 psf after 15 minutes of exposure in accordance with ASTM E331.

2.04 Accessories

A. Extrusions, formed members, sheet and plate shall conform with ASTM B209 and the recommendations of the manufacturer.

B. Panel stiffeners, if required, shall be structurally fastened or restrained at the ends and shall be secured to the rear face of the composite panel with silicone of sufficient size and strength to maintain panel flatness. Stiffener material and/or finish shall be compatible with the silicone.

C. Sealants and gaskets within the panel system shall be as per manufacturer's standards to meet performance requirements.

D. Fabricate flashing materials from 0.040" minimum thickness aluminum sheet or as recommended by panel manufacturer to match the adjacent curtain wall/panel system where exposed. Post-painted spray-applied flashings are not acceptable. Provide a lap strap under the flashing at abutted conditions and seal lapped surfaces with a full bead of non-hardening sealant.

E. Fasteners (concealed/non-corrosive): Fasteners as recommended by system manufacturer.

Part 3 – Execution

3.01 Inspection

A. Surfaces to receive panels shall be even, smooth, sound, clean, dry and free from defects detrimental to work. Notify contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with erection until unsatisfactory conditions have been corrected.

B. Surfaces to receive panels shall be structurally sound as determined by a registered engineer. In no case shall metal structural supports be less than 18 gauge.

3.02 Installation

A. Erect panels plumb and level.

B. Attachment system shall allow for the free vertical and horizontal thermal movement due to expansion and contraction for a material temperature range of -20ºF (-29ºC) to +180ºF (+82ºC). Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement are not permitted. Fabrication, assembly and erection procedure shall account for the ambient temperature at the time of the respective operation.

C. Panels shall be erected in accordance with an approved set of shop drawings.

D. Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.

E. Conform to panel fabricator's instructions for installation of concealed fasteners.

F. Do not install component parts that are observed to be defective, including warped, bowed, dented, scraped and broken members.

G. Do not cut, trim, weld or scrape component parts during erection in a manner that would damage the finish, decrease strength or result in a visual imperfection or a failure in performance. Return component parts that require alteration to shop for re-fabrication, or for replacement with new parts.

H. Separate dissimilar metals; use appropriate gaskets and fasteners to minimize corrosive or electrolytic action between metals.

3.03 Adjusting and Cleaning

A. Remove and replace panels damaged beyond repair as a direct result of panel installation. After installation, panel repair and replacement shall become the responsibility of the general contractor.

B. Repair panels with minor damage.

C. Remove masking film (if used) as soon as possible after installation. Masking intentionally left in place after panel installation on an elevation shall become the responsibility of the general contractor.

D. Any additional protection, after installation, shall be the responsibility of the general contractor to remove.

E. Make sure weep holes and drainage channels are unobstructed and free of dirt and sealants.

F. Final cleaning shall not be part of the work of this section.

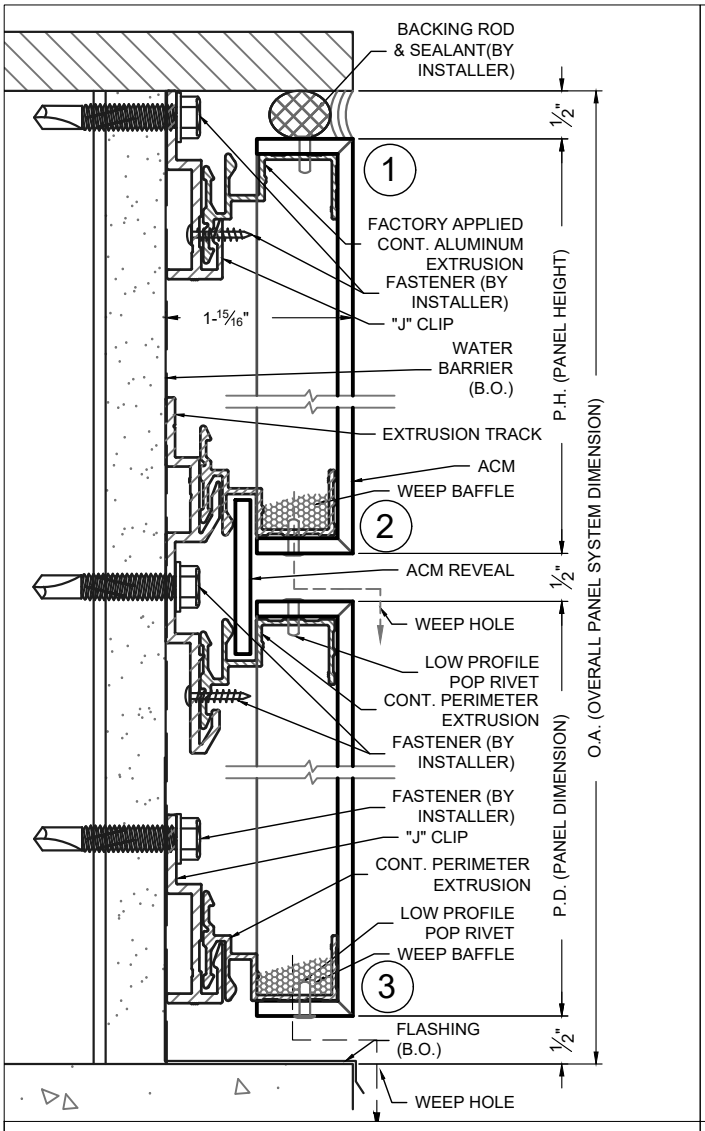
End of Section 074200

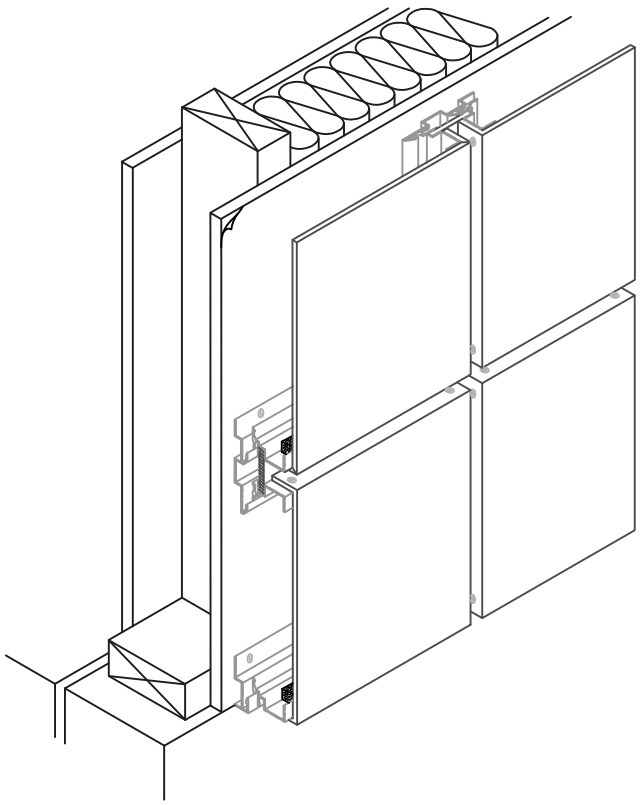
PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com





① TYPICAL HEAD DETAIL
② TYPICAL HORIZONTAL/VERTICAL JOINT
③ TYPICAL BASE JOINT

PAC-3000 RS PANEL SYSTEM - ISOMETRIC

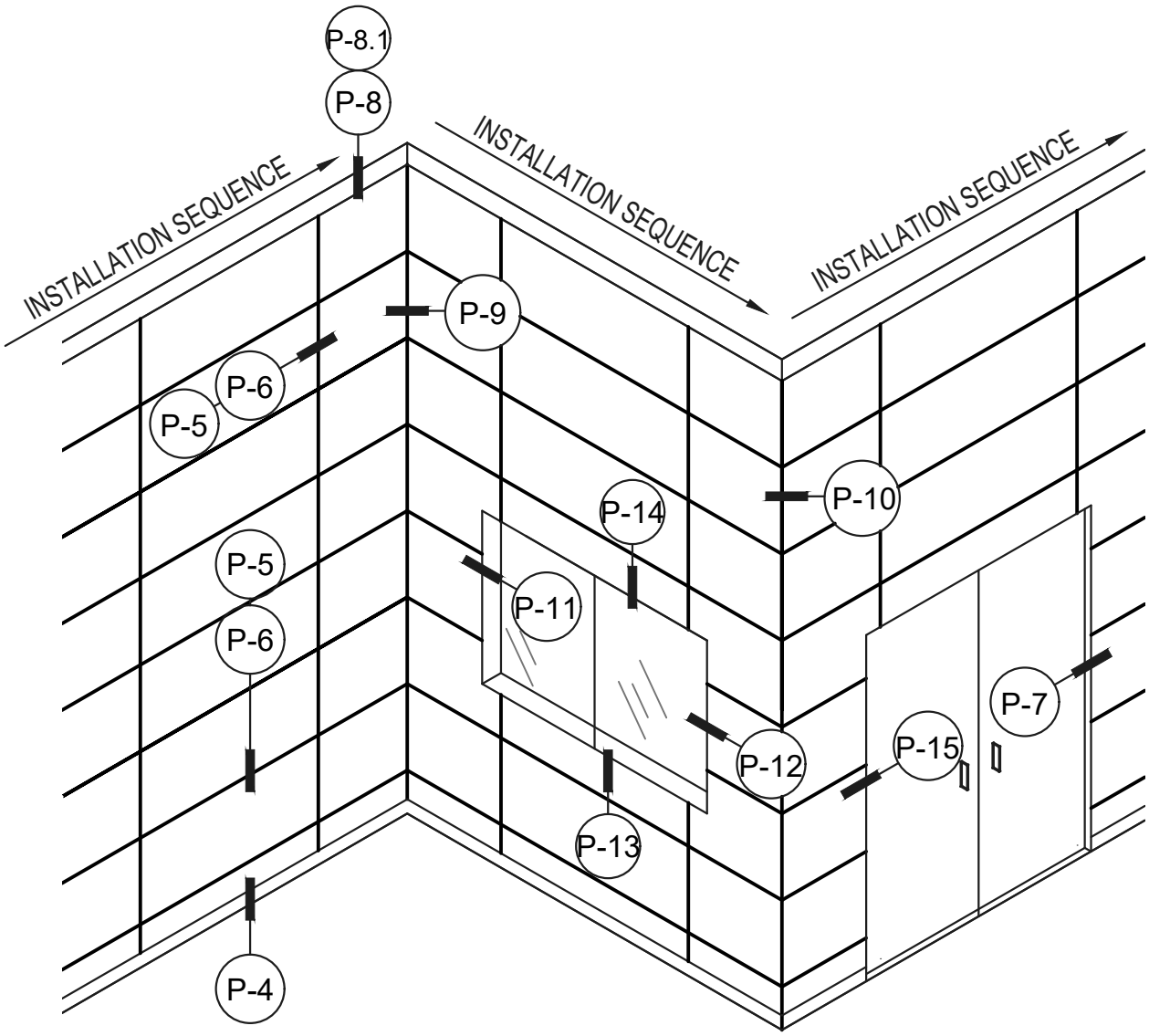
PAC-3000 RS Dry Joint System

The PAC-3000 RS Aluminum Composite Panel (ACP) System allows minimal water permeation. The minimal amount of water that does penetrate the system drains through weep holes. This system utilizes full length perimeter extrusions with 6" clips. The PAC-3000 RS utilizes a "floating" panel attached to the extrusion to provide an ACM reveal of ½" to 12". The system requires no caulking with the exception of joints at perimeter edges. The PAC-3000 RS provides a hi-tech, clean look and is easy to install.

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com

PAC-3000 RS COMPOSITE PANEL SYSTEM



ABBREVIATIONS

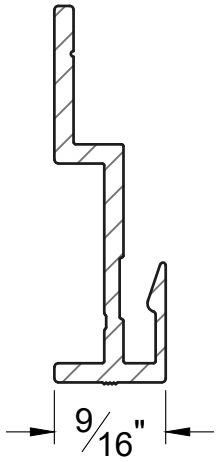
ACM = ALUM. COMPOSITE MATERIAL
B.O. = BY OTHERS
O.A. = OVERALL PANEL SYSTEM DIMENSION
P.D. = PANEL DIMENSION
P.H. = PANEL HEIGHT
P.W. = PANEL WIDTH

INDEX

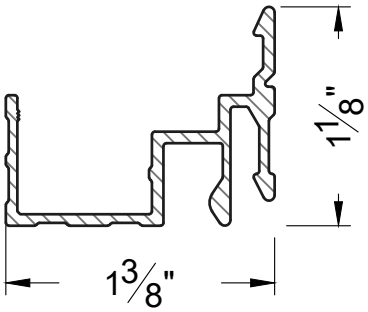
(P-2): SYSTEM OVERVIEW
(P-3): EXTRUSIONS
(P-4) - (P-18): SYSTEM DETAILS

PAC-CLAD PETERSEN
A CARLISLE COMPANY
9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com

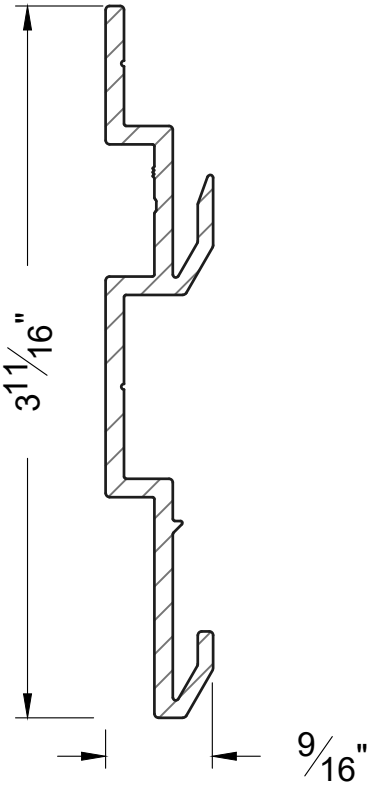
ATTACHMENT EXTRUSIONS



"J" CLIP EXTRUSION
(STARTER STRIP)



FACTORY APPLIED
CONTINUOUS ALUMINUM
EXTRUSION



TRACK CLIP
EXTRUSION

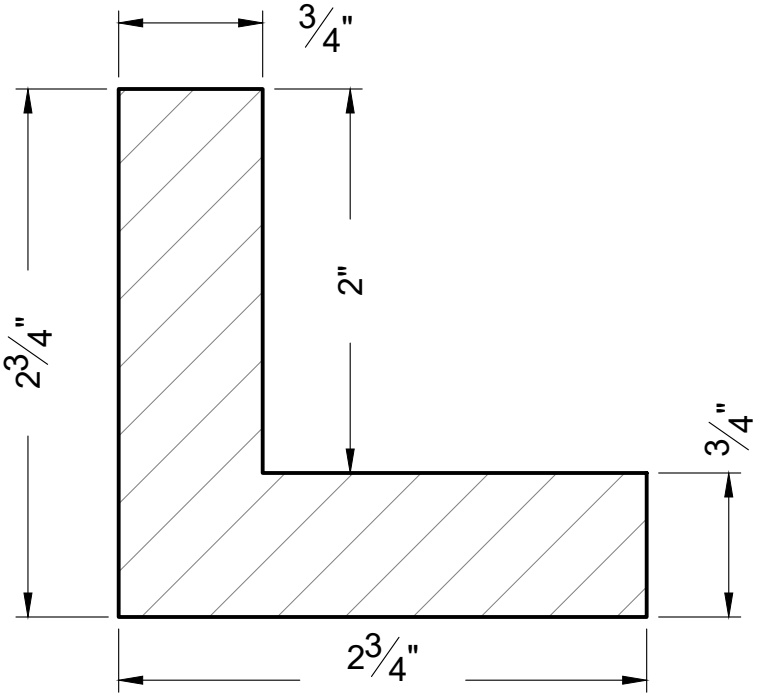
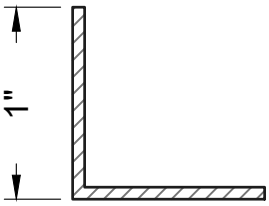


PLATE PANEL RETURN REINFORCEMENT

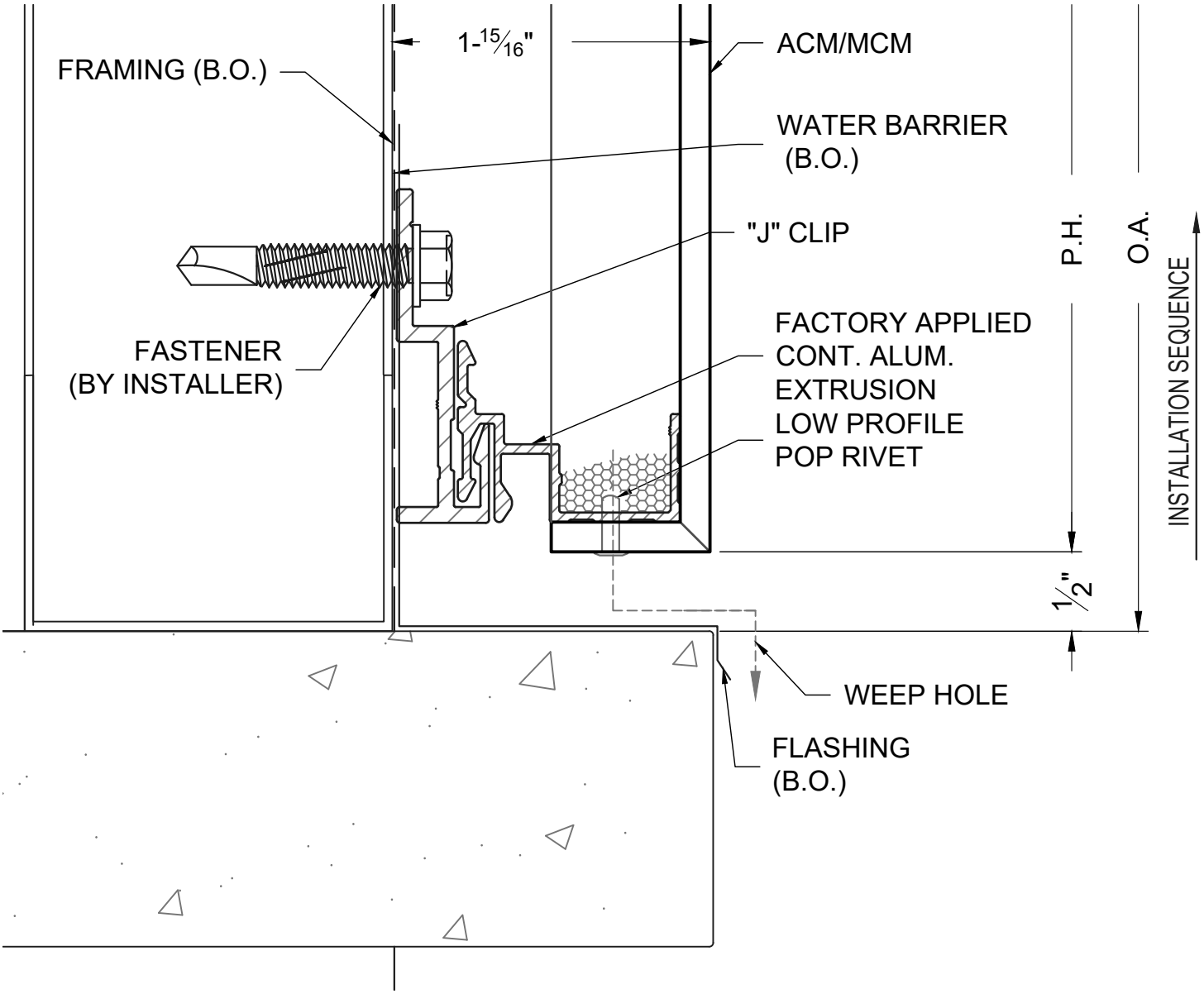


PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



SILL CONDITION

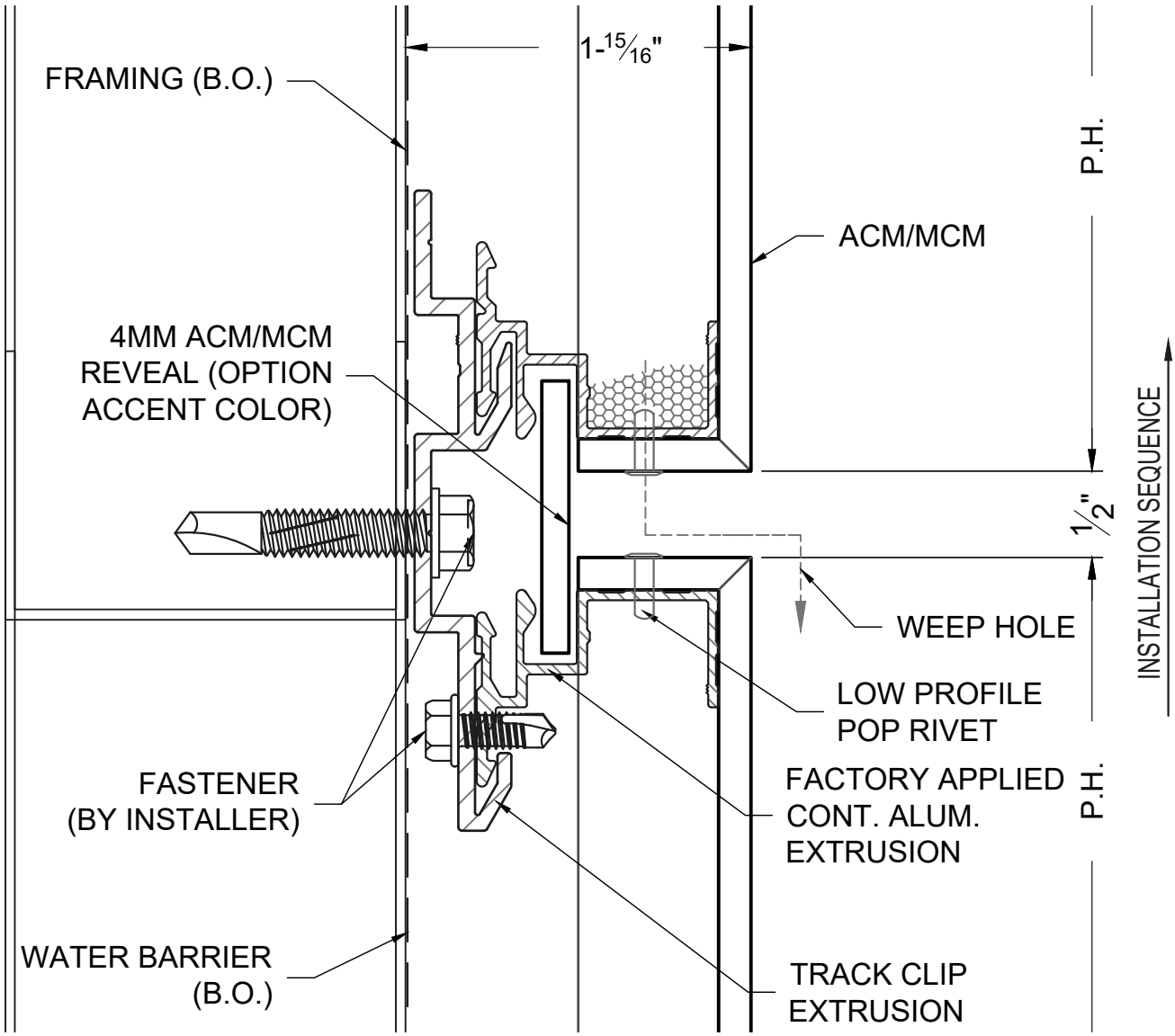
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



HORIZONTAL / VERTICAL JOINT-
TYPICAL JOINT

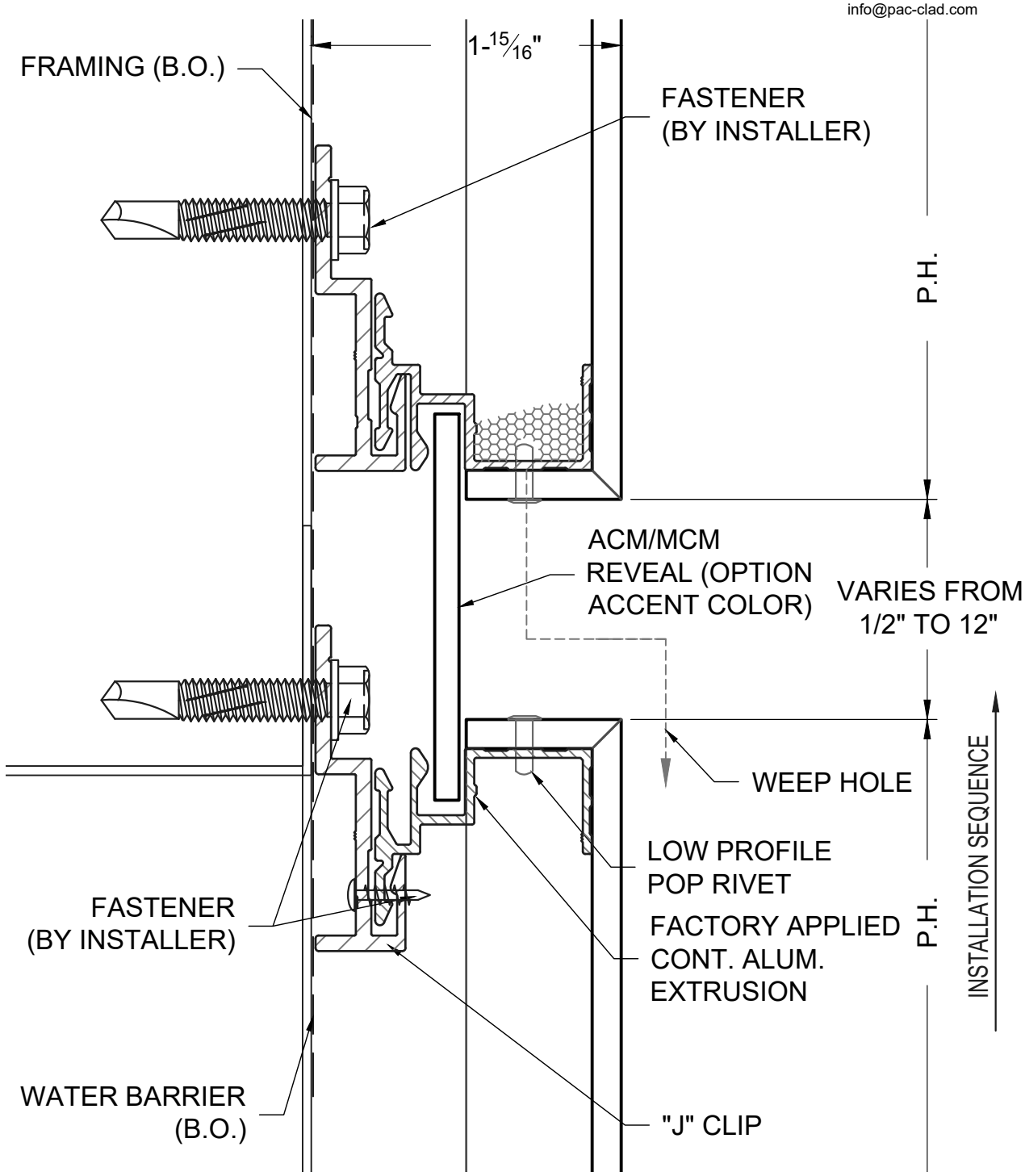
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



HORIZONTAL / VERTICAL JOINT-
WIDE JOINT

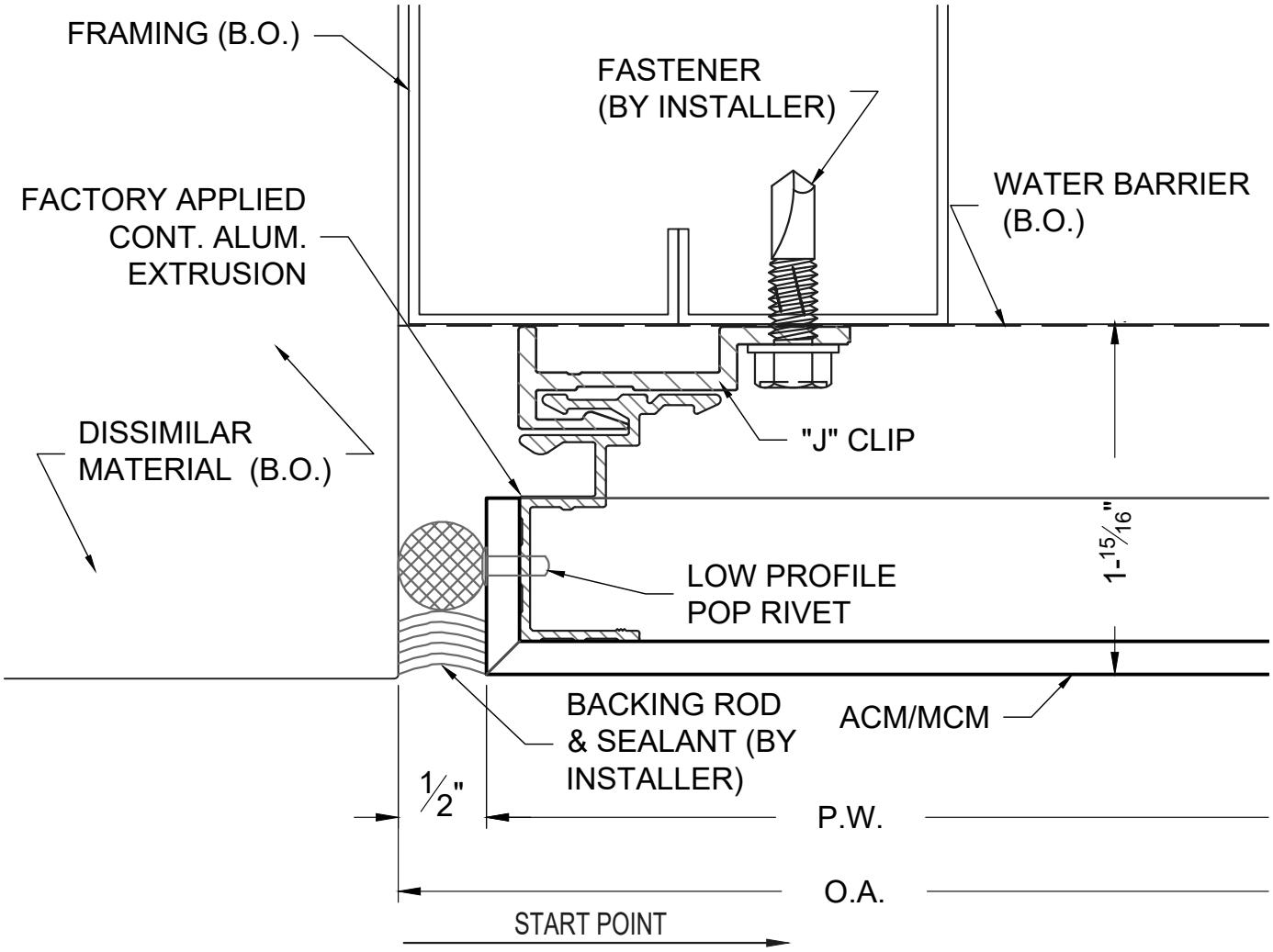
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



START CONDITION

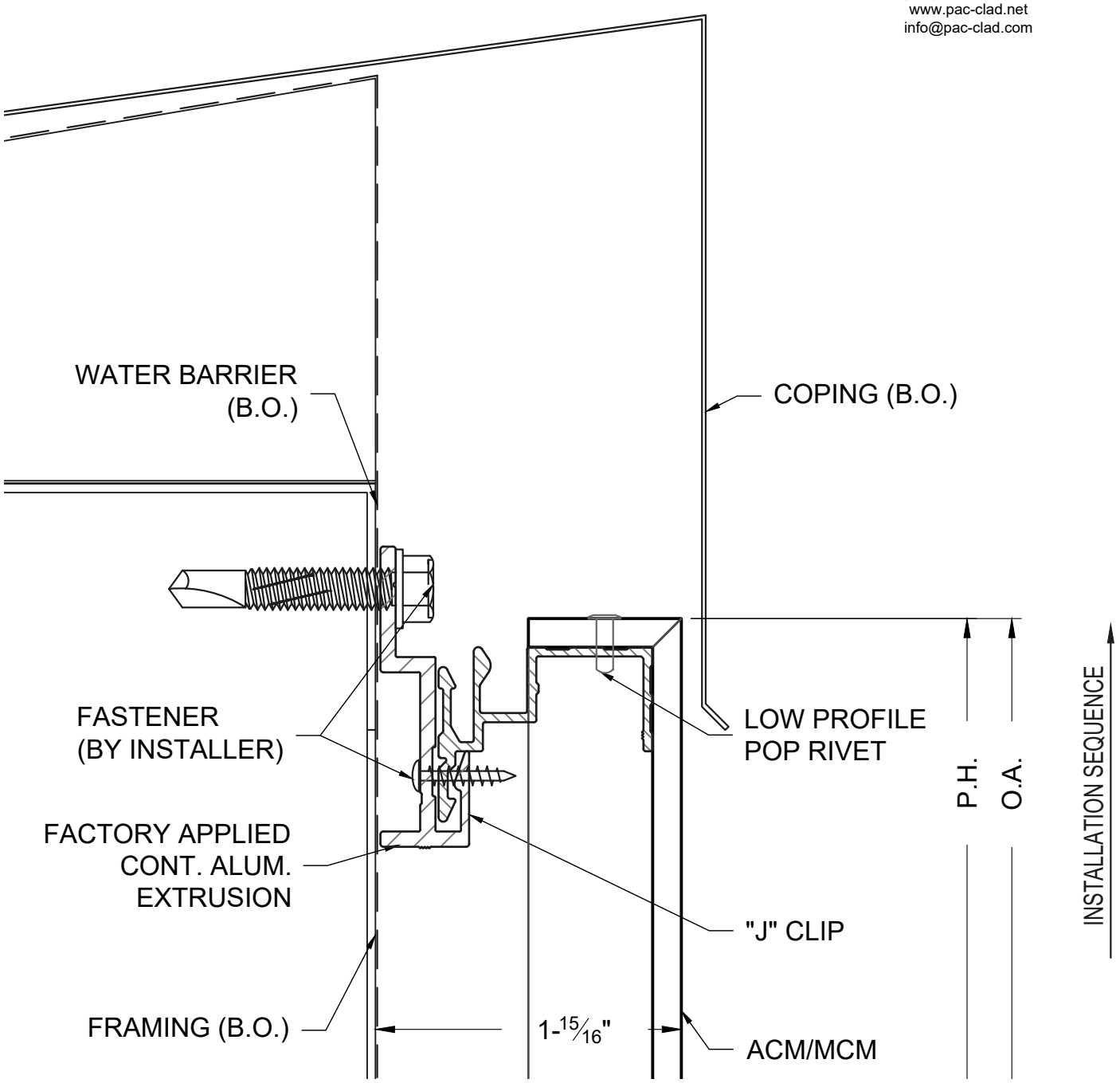
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



PARAPET CONDITION

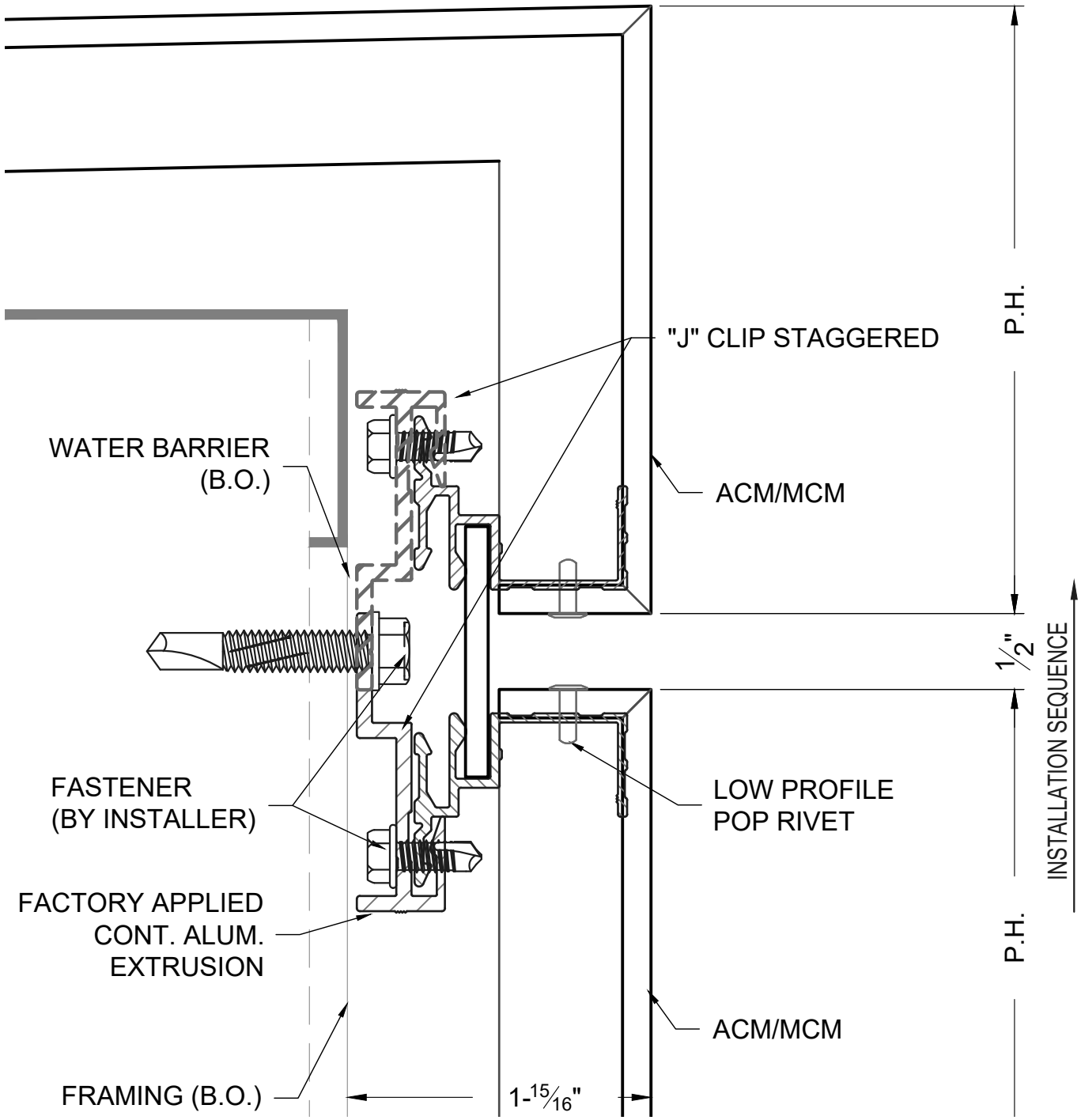
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



COPING CONDITION

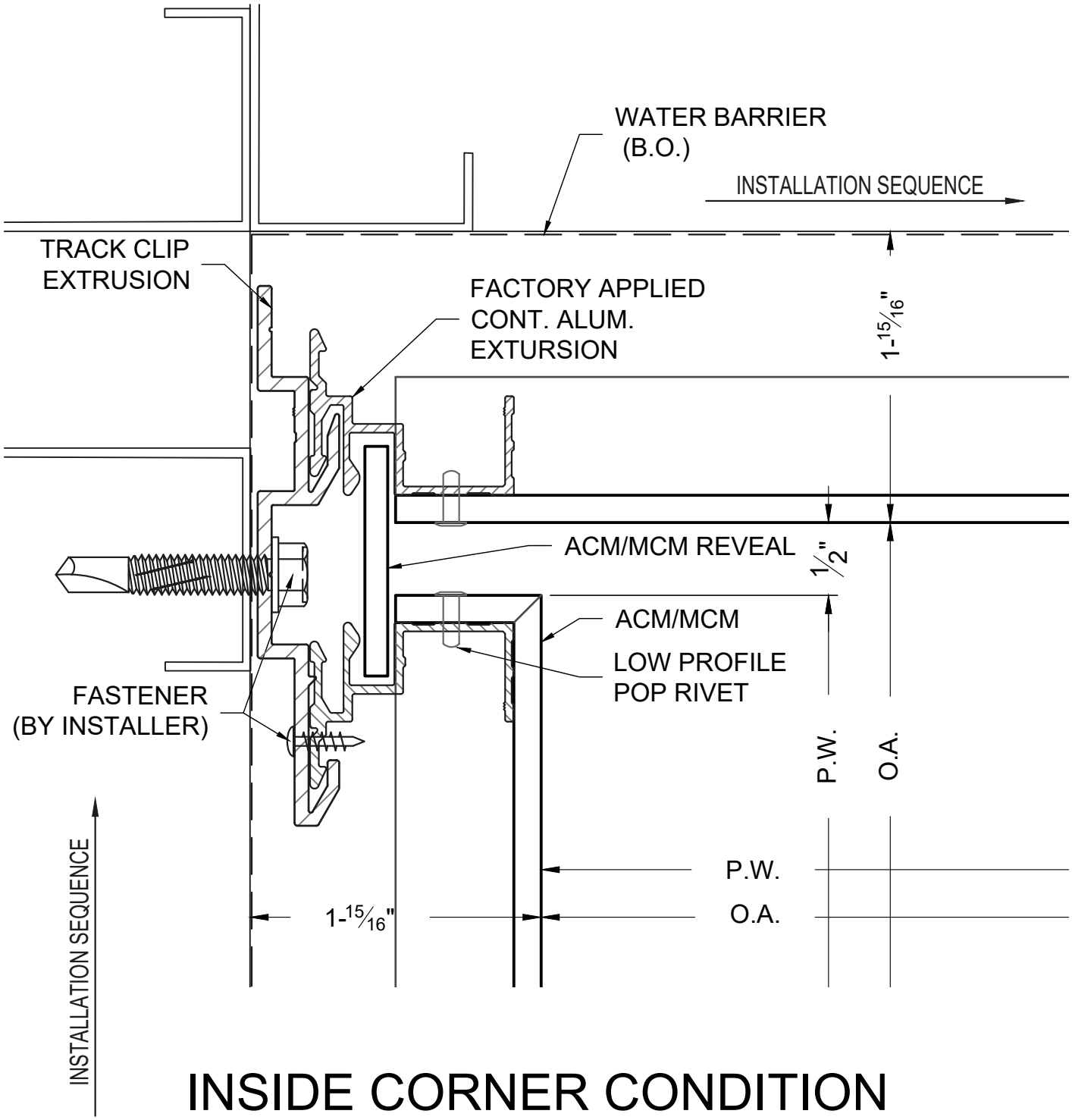
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



INSIDE CORNER CONDITION

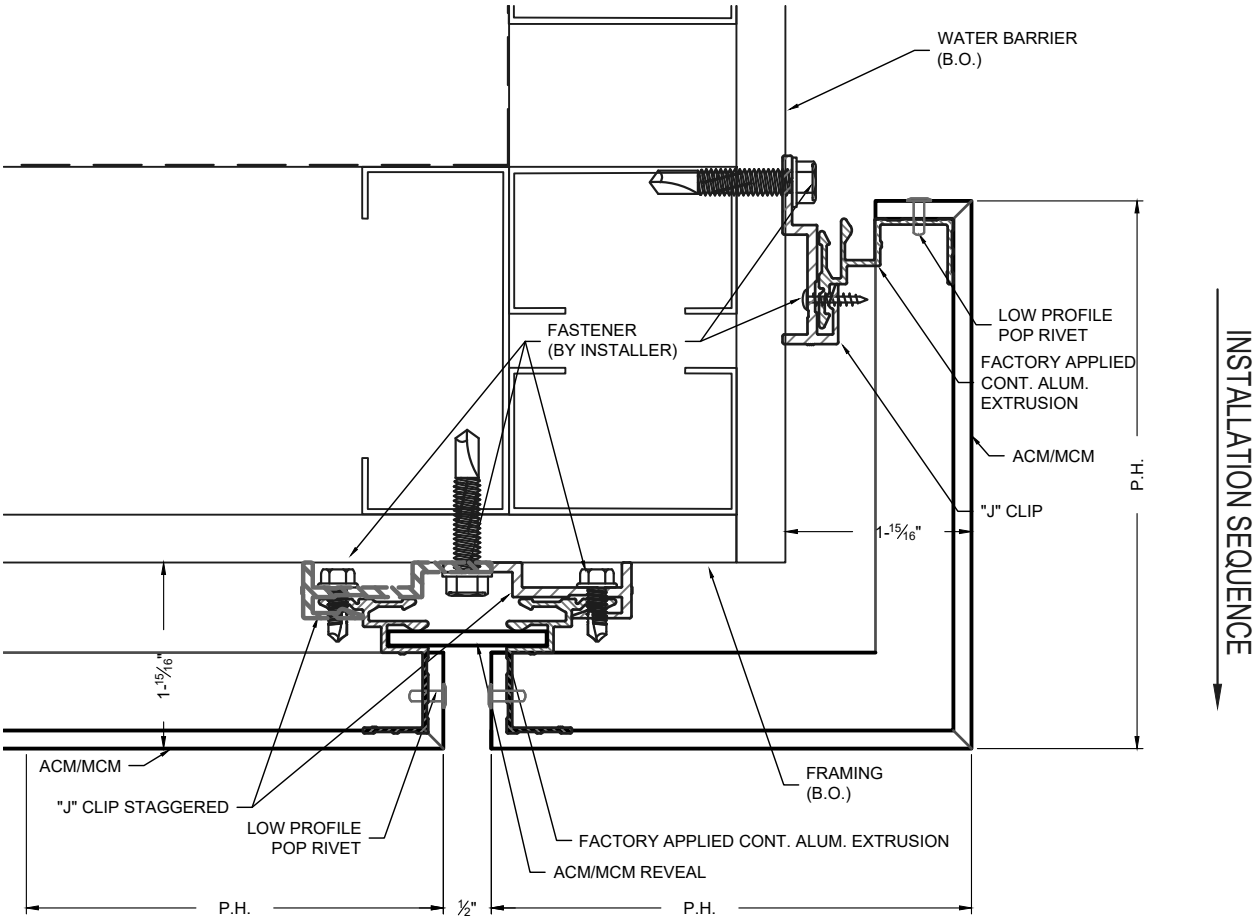
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



INSTALLATION SEQUENCE

SOFFIT CONDITION

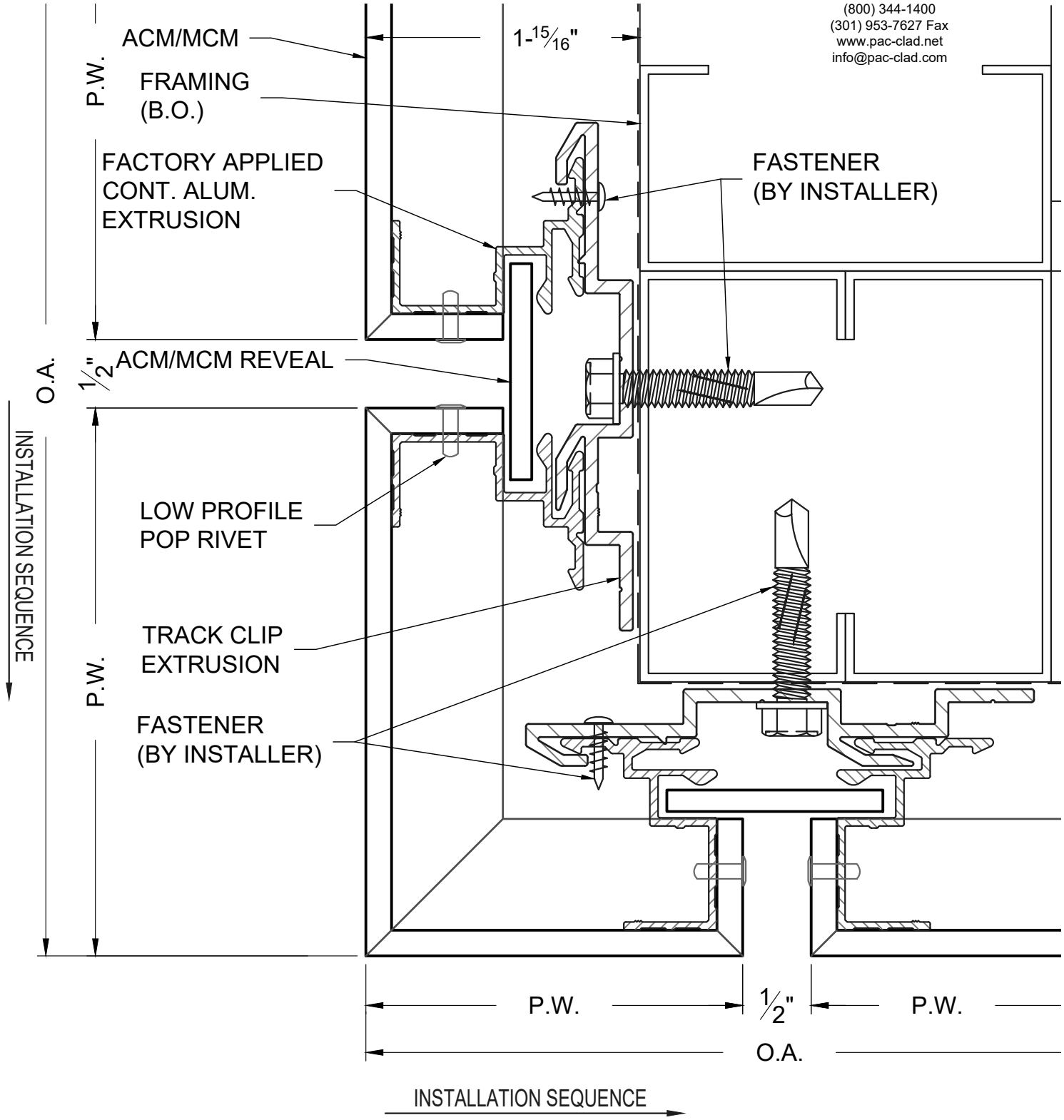
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



OUTSIDE CORNER

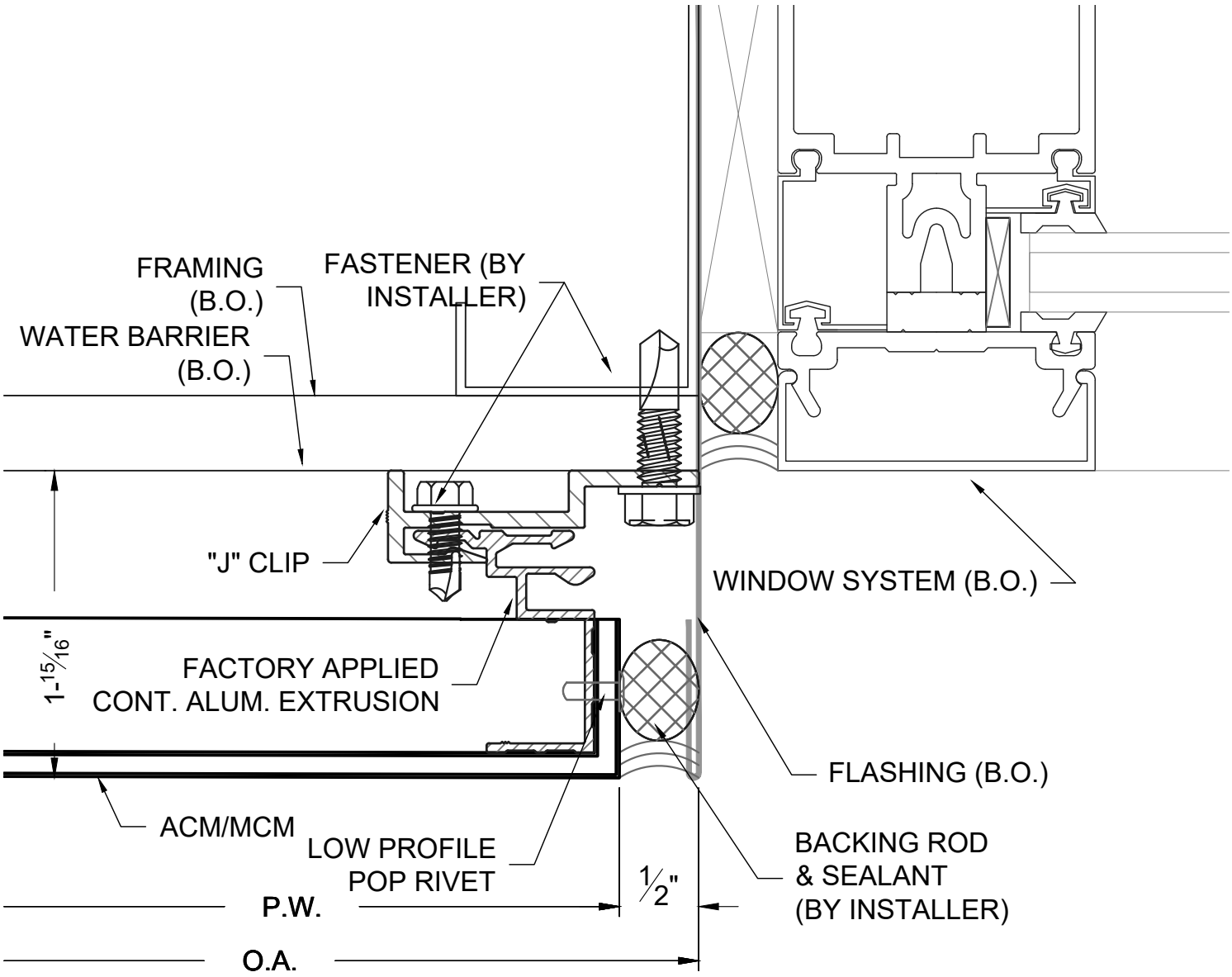
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



WINDOW CONDITION

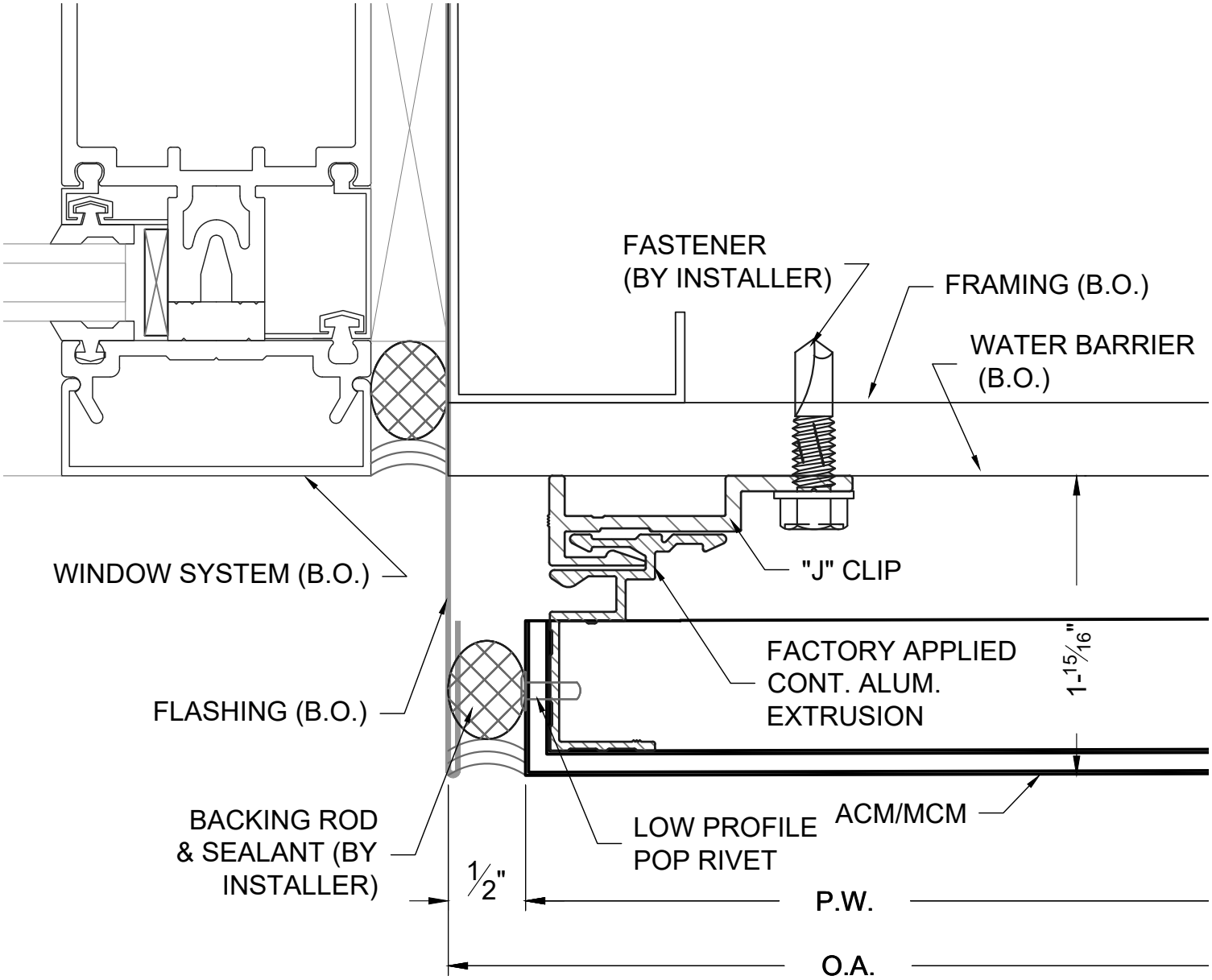
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



WINDOW CONDITION

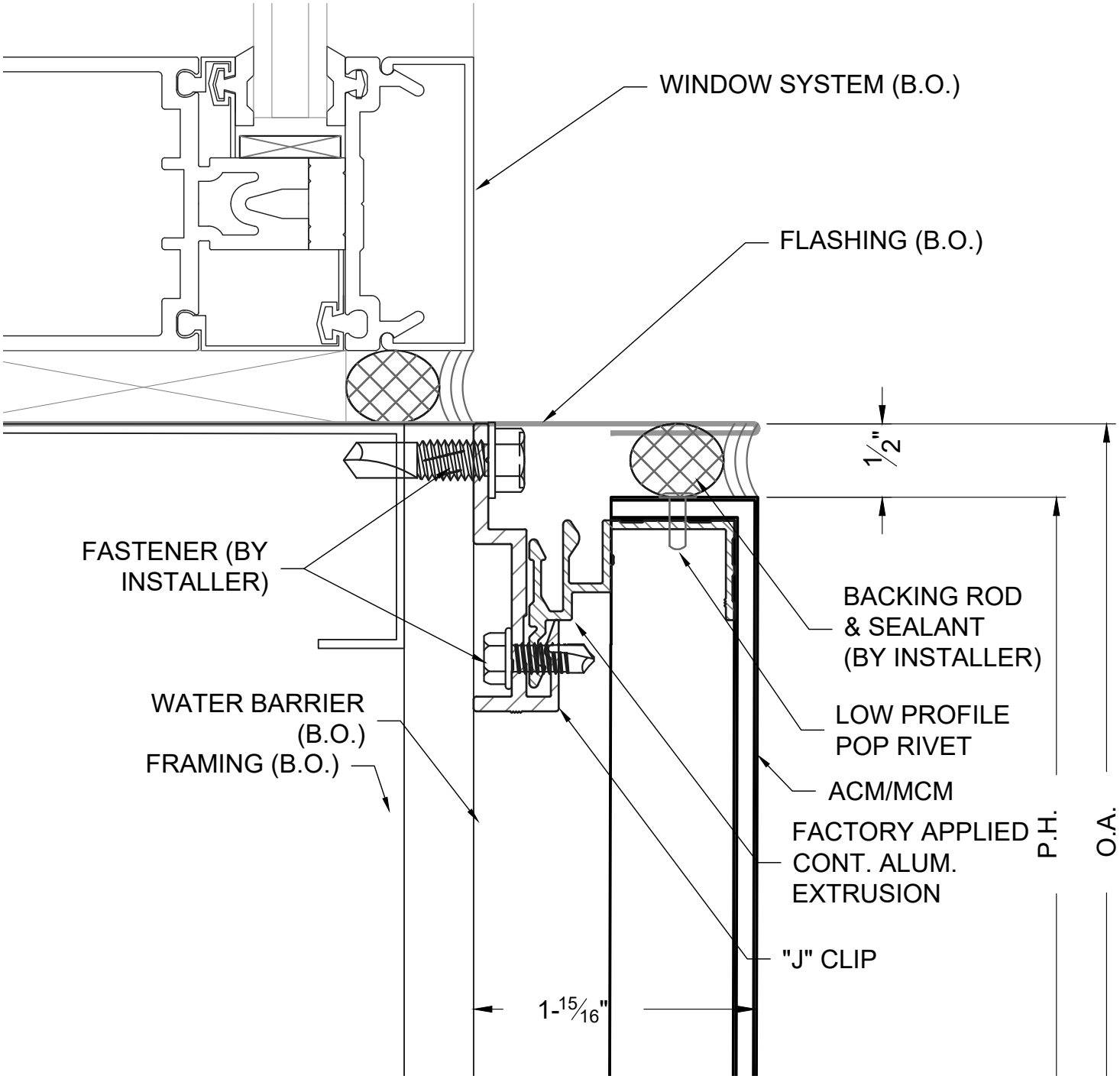
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



WINDOW SILL CONDITION

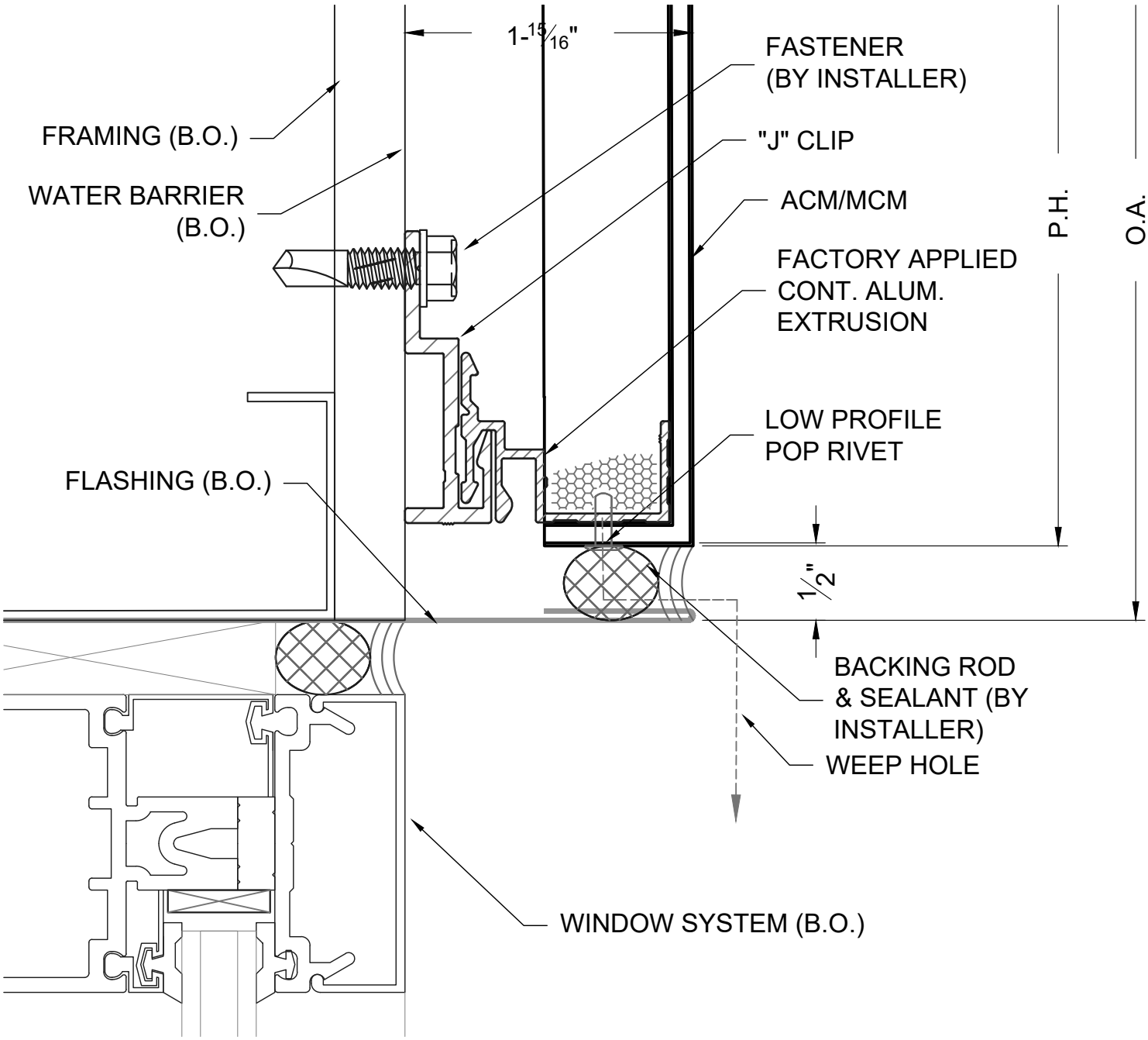
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



WINDOW HEAD CONDITION

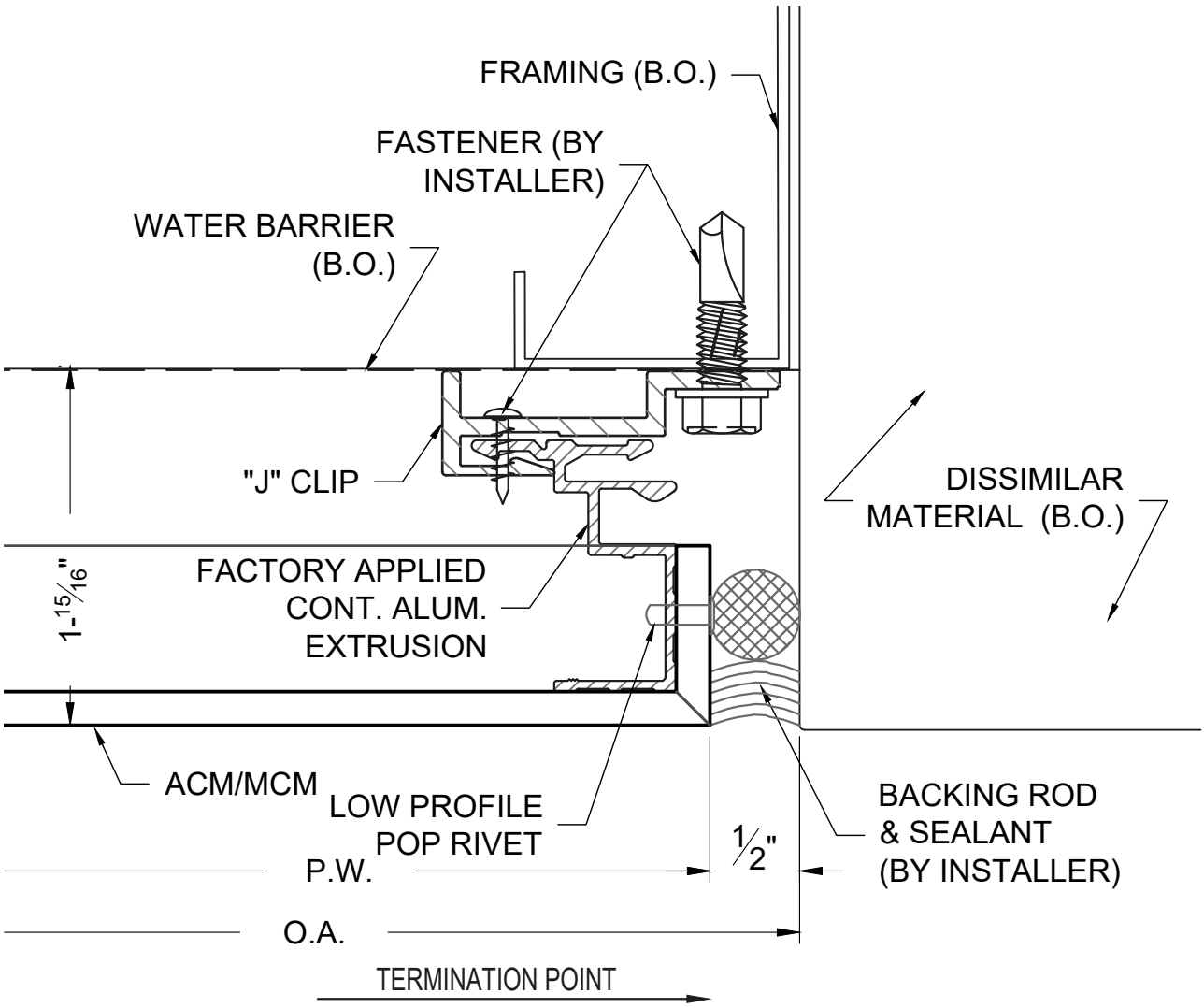
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



TERMINATION CONDITION

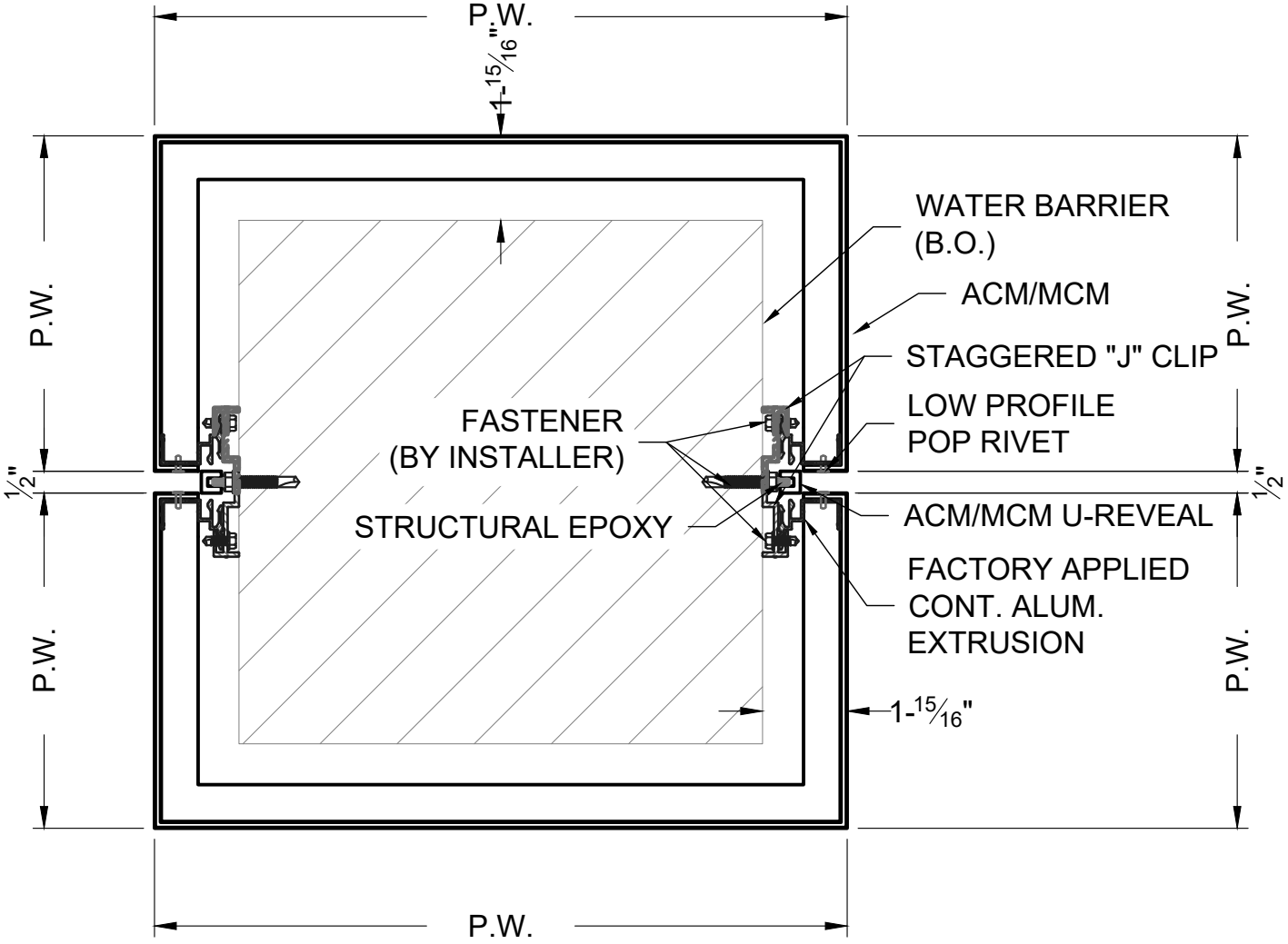
1:1

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



COLUMN CONDITION

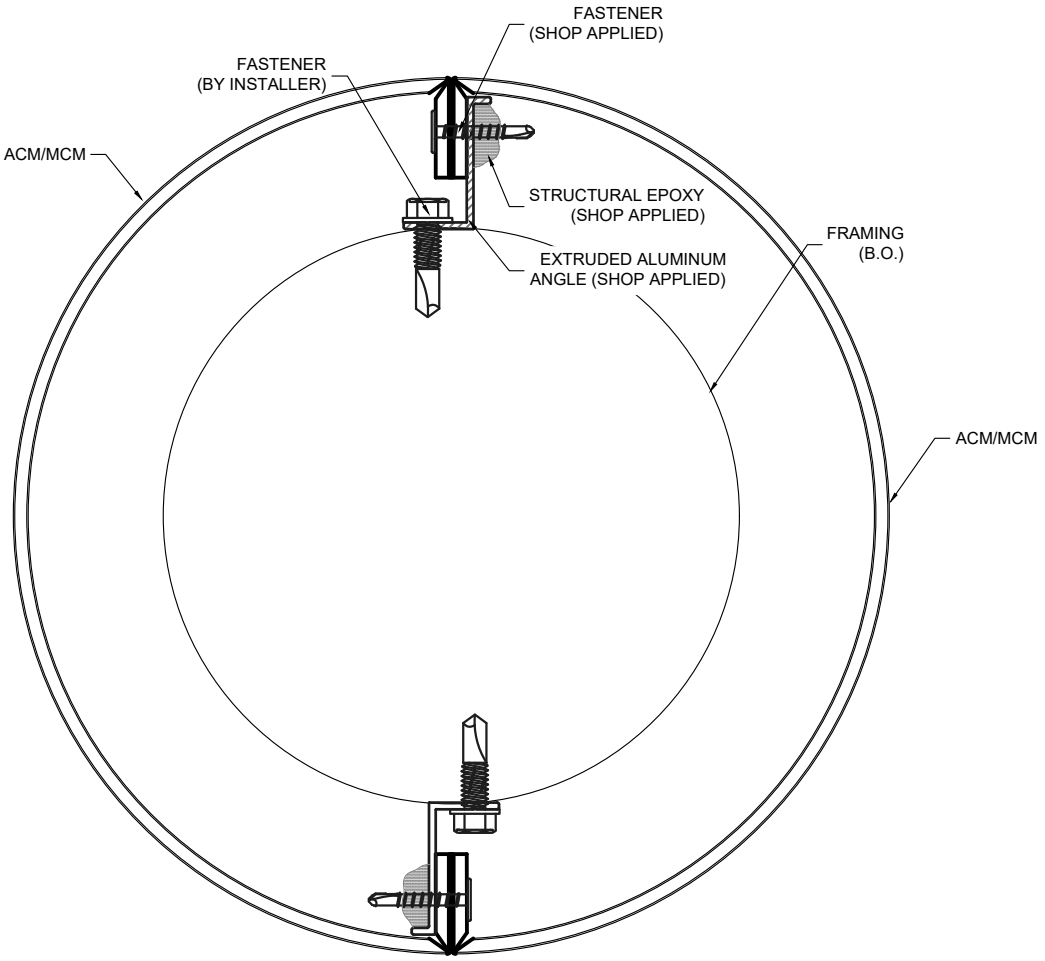
3":1'-0"

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



COLUMN CONDITION

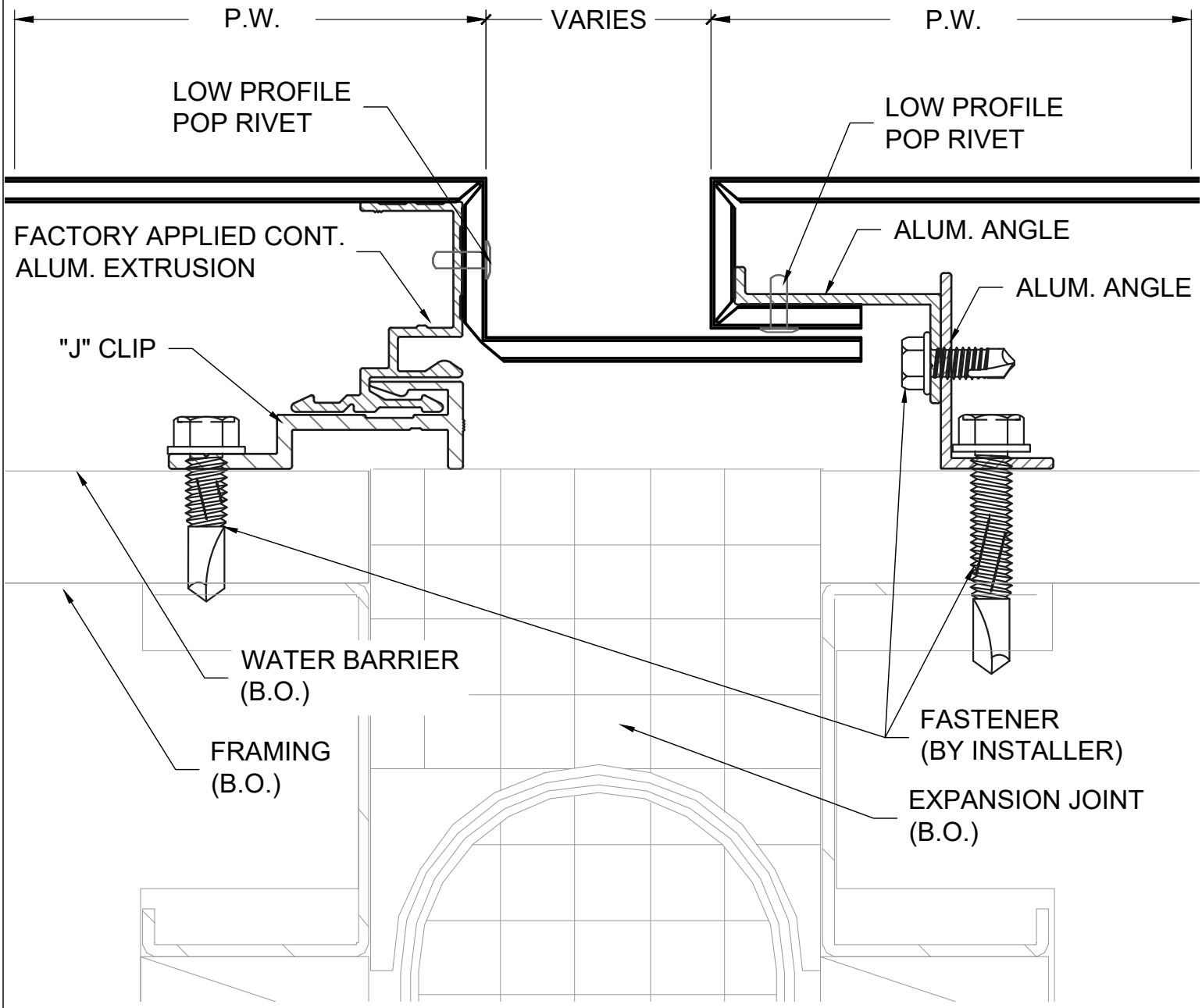
6":1'-0"

PAC-3000 RS

RAIN SCREEN PRESSURE EQUALIZED
DRY-JOINT SYSTEM

PAC-CLAD PETERSEN
A CARLISLE COMPANY

9060 Junction Drive
Annapolis Junction, MD 20701
(800) 344-1400
(301) 953-7627 Fax
www.pac-clad.net
info@pac-clad.com



EXPANSION JOINT

1:1

SECTION 07 42 13

METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior metal wall panels and associated flashing, trim, closures, subgirts, sealants, fasteners and accessories necessary to form the exterior metal wall panel system as shown on the contract drawings and/or specified herein.
2. Concealed fastener soffit panels.

B. Related Sections
1. Section 05 12 00 - Structural Steel Framing.
2. Section 05 50 00 - Metal Fabrication.
3. Section 06 10 00 - Rough Carpentry.
4. Section 07 62 00 - Sheet Metal Flashing and Trim.
5. Section 07 92 00 - Joint Sealants
6. **Section 01 91 19 - Building Envelope Commissioning**
7. **Section 07 05 23 - Pressure Testing the Air Barrier System for Air Tightness**

1.2 ASSEMBLY DESCRIPTION

A. The wall assembly includes concealed-fastener, lap-seam, preformed sheet metal panels, related accessories, miscellaneous flashing and attaching devices.

B. Wall panel system shall be manufactured and installed to withstand specified design loads and maintain performance requirements without defects, damage, or failure.

C. Performance Requirements:
1. Design wind loads to resist wind pressures based on a 3-second gust of 120 miles per hour, acting normal to the plane of the wall, or as indicated on the contract drawings.
2. There shall be no uncontrolled water penetration to the building interior when the wall panel system is tested per ASTM E 331 at a positive pressure differential of 6.24 psf or 20% of the design wind pressure whichever is greater. The test pressure need not exceed 12 psf.
3. Wall panels shall be designed for a maximum deflection under loading of L/180.

1.3 SUBMITTALS

A. Product Data:
1. Product specifications, details, certified product test results, installation instructions and general recommendations.
2. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
3. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

B. Samples: 2 samples 12" x 12" inch square, of each exposed finish material.

C. Submit panel shop drawings consisting of design and erection drawings, finish specifications, and other data necessary to clearly describe the design, materials, sizes, layouts, construction details, and erection. Submit small-scale layouts of panels and large-scale details of edge conditions, joints, fastener and sealant placement, flashings, penetrations, and special details. Distinction must be made between factory and field assembled work.
1. Drawings must be approved prior to fabrication.

D. Certification: Wind and Fire ratings of products incorporated into wall system.

E. Calculations: Include calculations with registered engineer seal, verifying wall panel and attachment method resist wind pressures imposed on it pursuant to applicable building codes.

F. Warranty: Sample copy of Manufacturer's and Applicator's warranty/guarantee.

G. LEED Submittals: Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.

B. Performance Test Standards: Provide preformed panel systems which have been pretested and certified by manufacturer to comply with requirements.

C. Take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

D. Fabrication: Comply with appropriate recommendations and details shown in "Architectural Sheet Metal Manual" by SMACNA.

E. Metal panel manufacturer shall certify that the Installer is approved by the manufacturer to install panels and provide warranties and guaranties.
   1. Certification shall be submitted upon letterhead of one of the approved manufacturers.
   2. Installer Information and Manufacturers Certifications are required for all installers whether they be the prime contractor or a subcontractor.
   3. Manufacturer: Company specializing in manufacturing the products specified in this section with 10 years documented experience and approved in writing by system manufacturer.
   4. Installer: Company specializing in performing the work of this section with minimum 5 years documented experience and approved in writing by system manufacturer.

1.5 DELIVERY. STORAGE AND HANDLING

A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.

B. Panels should be stored in a clean, dry place. One end should be elevated to allow moisture to run off.

C. Panels with strippable film must not be stored in the open, exposed to the sun.

D. Stack all materials to prevent damage and to allow for adequate ventilation.

1.6 WARRANTY

A. Paint finish shall have a 20 year warranty against cracking, peeling chalking and fade (not to exceed 5 N.B.S. units).

B. Galvalume substrate material shall have a 20 year warranty against failure due to corrosion, rupture or perforation and deterioration of metals and other materials beyond normal weathering.

C. Applicator shall furnish warranty covering watertightness of the wall system for the period of two (2) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Basis of Design Preformed Metal Wall Panels: Product description based on Pac Clad (for bidding purposes). Provide specified products or approved equal.
   1. Box Rib 1 Panel Concealed-Fastener, Lap-Seam Metal Wall Panel as manufactured by Pac Clad or approved equal.
   2. Panel width: 12" nominal width.
   3. Panel height: 1-3/8"

4. Anchor: 16 ga. panel concealed clips.
5. Thickness: 22 ga.
6. Vinyl Weather seal
7. Accessories: as required.

C. Concealed Fastener Soffit Panels: Provide Pac Clad PAC-750 Soffit Panel panels or approved equal.
1. Metal Gauge: 24 gauge.
2. Metal: Prefinished Metal - Hot-Dipped Galvanized, ASTM A446-85 Grade C G90 coating, ASTM A525-86.
3. Accessories: Provide components re-quired for a complete soffit system, including trim, clips, seam covers, flashings, sealants, gaskets, fillers, closure strips and similar items.

D. Finish: KYNAR 500/ HYLAR 5000 fluorocarbon coating on galvalume sheet. Colors as stated in schedule on drawings.
1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat applied by panel manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75± 0.05 mil (0.019± 0.0013 mm) over 0.2± 0.05 mil (0.05± 0.0013 mm) primer coat, to provide a total dry film thickness of 0.95± 0.10 mil (0.024± 0.0025 mm). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.2 UNDERLA YMENT/SUBSTRATE

A. 3/4" Exterior Grade Plywood Treated and Treated Wood Blocking.

B. Inspect framing to verify free of depressions, waves or projections, level to ¼” in 20'

C. Verify openings, curbs, pipes, sleeves, ducts or vents through wall are solidly set.

2.3 MISCELLANEOUS MATERIALS

A. Ice and Water Shield by W.R. Grace.

Property	Value	Test Method
Color	Gray-Black	
Thickness, membrane	40 mil (1.02 mm)	ASTM D3767 procedure A,Sec.9.1
Tensil strength, membrane	250 psi (1720 kN/m2)	ASTM D412 (Die C Modified)
Elongation, membrane	250%	ASTM D412 (Die C Modified)
Low temperature flexibility	Unaffected @-20°F(-29°C)	ASTMD1970
Adhesion to plywood	3.0lbs/in. width (525 N/m)	ASTMD903
Permeance (max)	0.05 Perms (2.9ng/m2s Pa)	ASTME96
Material weight installed (max)	0.3 lb/ft^2 (1.3 kg/m2)	ASTMD461

B. Self-adhered vapor permeable 1/8 water & air barrier Blue Skin VP TM 160 by Henry or Approved Equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify substrate is clean and smooth, flat, free of depressions, waves, or projections, and suitable for installation of wall panel system.

C. Examine wall framing to verify that girts, angles, channels, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

D. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

E. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate.

F. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
   2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
   3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
   5. Flash and seal panels with weather closures at perimeter of all openings.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Metal Soffit Panels:
   1. Joint Sealers: Install gaskets, joint fillers and sealants as recommended by panel manufacturer.
   2. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials which are non-compatible or could result in corrosion or deterioration of either material or finishes.
   3. Fabricate panel joints with captive gaskets or separator strips, which provide a tight seal and prevent metal-to-metal contact in a manner which will minimize noise from movements within panel system.
   4. Attachment to metal supports with #8 x 12” TEKS screws at maximum spacing of 2’-0” on center or per local code, whichever is greater.

3.3 CLEANING

A. Clean any grease, finger marks or stains from the panels per manufacturer's recommendations.

B. Remove all scrap and construction debris from the site.

3.4 CLEANING AND PROTECTION

A. Replace bent, cut, warped, chipped or otherwise damaged panels.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Panels with damaged finish shall be replaced. Finish touchup and similar minor repairs shall be approved by the Manufacturer. The Owner reserves the right to reject unsatisfactorily repaired panels as determined by the Owner.

D. Cleaning: Remove temporary protective coverings and strippable films as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

3.5 FINAL INSPECTION

A. Final inspection will be performed by a firm appointed and paid for by the owner.

3.6 COMMISSIONING

A. **Field Quality Control: Quality Assurance Inspections: Metal wall panels materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.**

END OF SECTION

SECTION 07 54 23

THERMOPLASTIC SINGLE-PLY ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Thermoplastic Polyolefin Single-Ply Roofing Membrane
2. Thermoplastic Polyolefin Flashings
3. Thermoplastic Polyolefin Accessories
4. Insulation

B. Related Sections
1. Section 06100: Rough Carpentry
2. Section 07620: Sheet Metal Flashing and Trim
3. Section 15430: Plumbing Specialties

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) - Annual Book of ASTM Standards
1. ASTM D-751 – Standard Test Methods for Coated Fabrics
2. ASTM D-2137 - Standard Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics
3. ASTM E-96 - Standard Test Methods for Water Vapor Transmission of Materials
4. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
5. ASTM D-471 - Standard Test Method for Rubber Property—Effect of Liquids
6. ASTM D-1149 - Standard Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment
7. ASTM C-1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
8. ASTM C-1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
9. ASTM E 903 – Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres
10. ASTM G155 - Standard Practice For Operating Xenon Arc Light Apparatus For Exposure Of Non-Metallic Materials
11. ASTM D573 - Standard Test Method For Rubber - Deterioration In An Air Oven

B. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - *Architectural Sheet Metal Manual*

C. National Roofing Contractors Association (NRCA)

D. U.S. Green Building Council (USGBC)
1. Leadership in Energy and Environmental Design (LEED)

E. California Title 24 Energy Efficient Standards

F. ENERGY STAR

G. Cool Roofing Rating Council (CRRC)

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) *Roofing and Waterproofing Manual* for definitions of roofing terms related to this section.

1.04 SUBMITTALS

A. Product Data: Provide product data sheets for each type of product indicated in this section.

B. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.

C. Samples: Provide samples of insulations, fasteners, membrane materials and accessories for verification of quality.

D. Certificates: Installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in this section.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: GAF shall provide a roofing system that meets or exceeds all criteria listed in this section.

B. Installer's Qualifications:

1. Installer shall be classified as a **GAF Commercial Chairman's Circle Contractor** as defined and certified by GAF.

2. Installer shall be classified as a **GAF PlatinumElite™ Commercial Contractor** as defined and certified by GAF.

3. Installer shall be classified as a **GAF GoldElite™ Commercial Contractor** as defined and certified by GAF.

4. Installer must be a **GAF Commercial Chairman's Circle or PlatinumElite™ Contractor** to offer WellRoof™ Guarantee Extension Program.

C. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

D. Final Inspection
Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

1.06 PRE-INSTALLATION CONFERENCE

A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, GAF representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions and agreements reached (or disagreements), and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.

1.07 PERFORMANCE REQUIREMENTS

A. GAF shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

1.08 REGULATORY REQUIREMENTS

A. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver all roofing materials to the site in original containers, with factory seals intact. All products are to carry a GAF label.

B. Store all pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.

C. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.

D. Remove manufacturer supplied plastic covers from materials provided with such. Use “breathable” type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.

E. Materials shall be stored above 55°F (12.6°C) a minimum of 24 hours prior to application.

1.10 PROJECT CONDITIONS

A. Weather
   1. Proceed with roofing only when existing and forecasted weather conditions permit.
   2. Ambient temperatures must be above 45°F (7.2°C) when applying hot asphalt or water based adhesives.

1.11 WARRANTY

A. Provide Manufacturers standard EverGuard® Diamond Pledge™ Guarantee with single source edge-to-edge coverage and no monetary limitation where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
   1. Duration: Twenty-Five (25) years from the date of completion.
      a) Covered components include GAF roofing membrane, liquid-applied membrane or coating, base flashing, high wall waterproofing flashing, insulation, expansion joint covers, preflashed accessories, and metal flashings used by the contractor of record that meet SMACNA standards (the “GAF Roofing Materials”).
      b) Materials and workmanship of listed products within this section are included when installed in accordance with current GAF application and specification requirements. Contact GAF Design Services for the full terms and conditions of the guarantee.
      c) Leaks caused by any non-GAF materials, such as the roof deck, existing materials, or non-GAF insulation are not covered.
   2. This system is eligible for a 90 mph Wind Addendum provided all current GAF application requirements are followed and guarantee procedures are met. This is based on GAF guarantee requirements and is not intended to modify, negate or alter any requirements specified by the design professional or others.

B. EverGuard® Hail Resistance Limited Warranty: GAF warrants to the original building owner, that the EverGuard® TPO roof membrane will resist hail damage when installed and maintained in accordance with GAF's requirements.

1. **Maximum hail size: 2"**

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Basis of Design Manufacturer: GAF, Commercial Roofing Products Division, which is located at: 1 Campus Drive; Parsippany, NJ 07054; Toll Free Tel: 877-423-7663 (option 4, then option 3); Email: designservices@gaf.com; Web: www.gaf.com

B. Other acceptable manufacturers: (Submit equal alternative in compliance with Section 012500 Substitution Procedures)
1. HOLCIM Elevate
2. Calisle SynTec
3. Verisco Roofing Systems
4. Johns Manville

2.02 INSULATION

A. Rigid polyisocyanurate board, with a glass-reinforced cellulosic felt facer. Conforms to or exceeds the requirements of ASTM C 1289 Type II, Class 1, Grade 2. **EnergyGuard™ Polyiso Insulation**, with the following characteristics:
1. Board Thickness: 2.6"
2. Thermal Resistance (LTTR value) of: 15
3. Board Size: 4' x 8'
4. Compressive Strength: 20 psi

B. Rigid polyisocyanurate board, with a glass-reinforced cellulosic felt facer. Conforms to or exceeds the requirements of ASTM C 1289 Type II, Class 1, Grade 2. **EnergyGuard™ Polyiso Insulation**, with the following characteristics:
1. Board Thickness: 2.6"
2. Thermal Resistance (LTTR value) of: 15
3. Board Size: 4' x 8'
4. Compressive Strength: 20 psi

2.03 COVER BOARD

A. Rigid polyisocyanurate cover board, with coated polymer-bonded glass fiber mat facers on both major surfaces of the core foam conforming to or exceeding the requirements of ASTM C 1289, Type 2, Class 4, Grade 1. **EnergyGuard™ HD Polyiso Cover Board**, with the following characteristics:
1. Board Thickness: ½" or 12.7mm
2. Board Size: 4' x 4'
3. Minimum Compressive Strength: 80psi (551kPa)
4. Thermal Resistance (LTTR value) of: >2.5

2.04 MEMBRANE MATERIALS

A. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed,

FM Approved, Dade County Product Approval, Florida Building Code Approved. White membrane is Energy Star Listed, CRRC Listed and Title 24 Compliant.

1. **EverGuard® TPO 80 Mil Membrane by GAF**.
   a) 10' X 100', each roll contains 1000 sq. ft. of material weighing 420 lbs.
   b) Color: White

2.05 CURB/WALL FLASHING MEMBRANE

A. GENERAL
1. EverGuard® membrane flashing should be of the same type and thickness as the roof membrane.
2. Because colored TPO membranes may exhibit different welding characteristics, please call the GAF Design Services hotline at 800-766-877-423-7663 Option 4, Option 3 before attempting to weld different-colored TPO membranes with white membranes or flashings.
3. EverGuard® TPO Fleece-Back membranes are optional flashing membranes for all EverGuard® TPO systems. These membranes may be a solution when a contaminated substrate is encountered.

B. FLASHING MEMBRANE
1. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane for use as a single ply roofing membrane. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed, FM Approved, Dade County Product Approval, Florida Building Code Approved. White membrane is Energy Star Listed, CRRC Listed and Title 24 Compliant.
   a) **EverGuard® TPO 80 Mil Membrane by GAF**.

2.06 ADHESIVES, SEALANTS AND PRIMERS

A. Sprayable, solvent-based contact adhesive used for bonding smooth EverGuard® and EverGuard® Extreme® TPO membranes. One canister covers 10 squares. **EverGuard® TPO Quick Spray Adhesive** by GAF.

B. Two component, construction grade low-rise polyurethane foam adhesive. The "A" and "B" components are dispensed from two pre-pressurized disposable cylinders utilizing a two-component disposable foam applicator. **LRF Adhesive XF** distributed by GAF.

C. Two component fast-acting, low-rise polyurethane foam adhesive. The "A" and "B" components are dispensed from two pre-pressurized disposable cylinders. **OlyBond500® Equipment Free Canister System** distributed by GAF.

D. Solvent based primer for preparing surfaces to receive butyl based adhesive tapes, **EverGuard® TPO Primer**, by GAF.

E. Solvent based seam cleaner used to clean exposed or contaminated seam prior to heat welding, **EverGuard® TPO Seam Cleaner, by GAF.**

F. Solvent based, trowel grade synthetic elastomeric sealant. Durable and UV resistant suitable for use where caulk is typically used. Available in 10 oz. tubes, **FlexSeal™ Caulk Grade Roof Sealant** by GAF.

G. Commercial grade roofing sealant suitable for sealing the upper lip of exposed termination bars and penetrations and around clamping rings. Meets the performance criteria of ASTM D412, ASTM D2196, ASTM D1475 and ASTM D1644, **FlexSeal™** Roof Sealant, by GAF.

H. Low VOC solvent based primer for preparing surfaces to receive butyl based adhesive tapes, **EverGuard® TPO Low VOC Primer**, by GAF.

I. Low VOC TPO cleaner designed to clean exposed or contaminated seams prior to heat welding to remove any residual soap or revitalize aged membranes. Contains only 50 grams per liter of Volatile Organic Content and has been formulated using a blend of primarily VOC-exempt ingredients to be in compliance with air quality regulations for single ply roofing products. **EverGuard® TPO CleanWeld® Conditioner** by GAF.

J. One part butyl based high viscosity sealant suitable for sealing between flashing membrane and substrate surface behind exposed termination bars and for sealing between roofing membrane and drain flange. **EverGuard® Water Block**, by GAF.

K. One-part, moisture-cure, self-leveling sealant designed for use in pitch pans on single ply roof systems.
EverGuard® One-Part Pourable Sealant.

2.07 FASTENERS AND PLATES

A. Mechanical Fasteners & Plates

1. **Drill-Tec™ #12 Fastener**: Standard duty alloy steel insulation fastener with CR-10 coating with a .220” diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips head for use on steel and wood decks.
2. **Drill-Tec™ Insulation Plates**: Galvalume, 3” (76 mm) diameter, suitable for use with Drill•Tec™ Standard and HD screws, and Drill•Tec™ Spikes. Special design available for use with Drill•Tec™ Polymer Screws.

2.08 FLASHING ACCESSORIES

A. GENERAL FLASHING ACCESSORIES

1. A smooth type, unreinforced thermoplastic polyolefin based membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Required whenever preformed vent boots cannot be used, available in White, 0.055 inches (55 mils) nominal thickness and sheet size: 24in x 50ft. **EverGuard Extreme® TPO Detailing Membrane**, by GAF.
2. An 8 inch (203 mm) wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs: 0.045 inches (45 mils) nominal thickness with 100 foot length, available in White, **EverGuard Extreme® TPO Flashing Membrane**, by GAF.
3. 25 mil TPO membrane laminated to galvanized sheet metal for fabrication into metal gravel stop and drip edge profiles, metal base and curb flashings, sealant pans, and scupper sleeves. **EverGuard Extreme ® TPO Coated Metal**, by GAF.
   a) Metal type: Available in 24 gauge, 20 gauge, Aluminum, and Stainless steel
   b) Sheets per pallet: Available in 5, 10, or 30
   c) Sheet Size: 4’ x 10’ or Custom size
   d) Sheet Color: White
      i) Custom colors available
4. Extruded aluminum termination bar with angled lip caulk receiver and lower leg bulb stiffener. Pre-punched slotted holes at 6” on center or 8” on center. ¾” x 10’ with 0.090” cross section, **DRILL-TEC™ Termination Bar,** by GAF.

B. FIELD OF ROOF ACCESSORIES

1. A smooth type, unreinforced thermoplastic polyolefin based membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Required whenever preformed vent boots cannot be used, 0.055 inches (55 mils) nominal thickness and sheet size: 24in x 50ft.

EverGuard Extreme® TPO UN-55 Detailing Membrane, by GAF.

2. An 8 inch (20 cm) wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs: 0.045 inches (45 mils) nominal thickness with 100 foot length, **EverGuard Extreme® TPO Utility Flashing Membrane**, by GAF.
3. 24 gauge steel with 0.025” thick TPO based film as required for fabrication into metal gravel stop and drip edge profiles, metal base and curb flashings, sealant pans, and scupper sleeves. Standard sheet size 4’ x 10’, sheet weight 47 lbs. Custom sizes available, **EverGuard Extreme® TPO Coated Metal**, by GAF.
4. Pre-manufactured expansion joint covers used to bridge expansion joint openings in a roof structure. Fabricated to accommodate all roof to wall and roof to roof applications, made of .060” reinforced TPO membrane, available in 5 standard sizes for expansion joint openings up to 8” wide. **EverGuard Extreme® TPO Expansion Joint Covers,** by GAF
5. .055” thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60, 70 and 80 mil membrane applications. **EverGuard Extreme® T-Joint Patches**, by GAF.

C. WALL & CURB ACCESSORIES

1. .045” reinforced TPO membrane with pressure sensitive adhesive, to be installed on horizontal surfaces using plates and fasteners as a base attachment in adhered systems. Size 6” x 100’, **EverGuard Extreme® RTA (Roof Transition Anchor) Strip™,** by GAF
2. 55 mil TPO membrane and 24 gauge coated metal prefabricated into standard and custom size thru wall scuppers**.** Available in two sizes: 4" x 6" x 12" (l x w x d) with a 5.75" x 3.75" opening and 8" x 10" x 12" (l x w x d) with a 9.75" x 7.75" opening, **EverGuard Extreme® TPO Scupper,** by GAF
3. .045” or .060” thick reinforced TPO membrane fabricated corners. Available in four standard sizes to flash curbs that are 24”, 36”, 48”, and 60” in size. Four corners are required to flash the curb, **EverGuard Extreme ® Corner Curb Wraps,** by GAF.
4. 0.060” thick molded TPO membrane outside corners of base and curb flashing. Hot-air welds directly to EverGuard® TPO membrane. Size 4” x 4” with 6” flange, **EverGuard Extreme ® TPO Universal Corners** by GAF.
5. 8” diameter, nominal .050” vacuum formed unreinforced TPO membrane for use in flashing outside corners of base and curb flashings, **EverGuard Extreme® TPO Fluted Corner**, by GAF.
6. 0.050” molded TPO membrane inside corners of base and curb flashing. Hot-air welds directly to EverGuard TPO membrane. Size 6” x 6” x 5.25” high **EverGuard Extreme® TPO Inside Corners** by GAF.

D. PENETRATION ACCESSORIES

1. 0.075” thick molded TPO membrane sized to accommodate most common pipe and conduits, (1” (25.4 mm) to 6” diameter pipes), including square tube. Hot-air welded directly to EverGuard® TPO membrane, supplied with stainless steel clamping rings, **EverGuard Extreme® TPO Preformed Vent Boots** by GAF.
2. 0.045” or 0.60” thick molded TPO membrane preformed boots are split to accommodate most common pipes and conduits and available in three standard sizes, **EverGuard Extreme® TPO Split Pipe Boots**, by GAF.
3. 0.045” or 0.60” thick molded TPO membrane preformed square boots are split to accommodate most common square penetrations and conduits and available in three standard sizes, **EverGuard Extreme® TPO Square Tube Wraps**, by GAF.

4. .070 thick molded penetration pocket to provide structure and foundation for the application of a pourable sealant for a variety of roof penetrations, weldable and 9" x 6" x 4" (l x w x h). **EverGuard Extreme® TPO Pourable Sealer Pocket**
5. 055” thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60 and 80 mil membrane applications. **EverGuard® TPO Drain** by GAF

E. WALKWAYS
1. 1/8” thick extruded and embossed TPO roll 34” x 50’, heat welds directly to roofing membrane. Unique herringbone traction surface. Available in gray or yellow, **EverGuard® TPO Walkway Rolls**, GAF.

PART 3 EXECUTION

3.01 SITE CONDITIONS

A. Obtain verification that the building structure can accommodate the added weight of the new roofing system.

B. Confirm the adequacy of the new roofing system to provide positive slope to drain. Eliminate ponding areas by the addition of drainage locations or by providing additional pitch to the roof surface.

C. Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for re-cover and reroofing applications. Providing a smooth, even, sound, clean, and dry substrate minimizes the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roofing system.

D. All defects in the roof deck or substrate must be corrected by the responsible parties before new roofing work commences. Verify that the deck surface is dry, sound, clean, and smooth, and free of depressions, waves, or projections.

E. Protect building surfaces against damage and contamination from roofing work.

F. Where work must continue over completed roof areas, protect the finished roofing system from damage.

G. Deck preparation is the sole responsibility of the building owner or roofing contractor. All defects in the roof deck or substrate must be corrected before roofing work commences.

H. Refer to GAF Roof Guarantee Program for specific requirements for extended guarantees.

3.02 SUBSTRATE PREPARATION

A. Steel Deck
1. Metal decks must be a minimum uncoated thickness of 22 gauge (0.8 mm) and shall have a G-90 galvanized finish on all panels.
2. When re-roofing over steel decks, surface corrosion shall be removed, and repairs to severely corroded areas made. Loose or inadequately secured decking shall be fastened, and irreparable or otherwise defective decking shall be replaced.
3. Code standards apply when their requirements exceed those listed here.

3.03 NAILER INSTALLATION

A. Acceptable Wood

1. Solid Blocking: Non-pressure treated wood as required, #2 Grade or better, nominal 1 1 /4" (30 mm) x 4" (102 mm) with a minimum thickness of 3 1 /2" (88 mm).
2. Shim Material: Plywood, 1 /2" (13 mm) x width to match solid blocking.
3. Verify the condition of existing roof nailers and anchor to resist 250 lb. per ft. (550 kg) load applied in any direction. New nailers should meet same load requirements.
4. DRILL-TEC™ HD screws 18" (457 mm) o.c. attachment to structural wood, steel decks with a 1" (25 mm) thread embedment.
5. DRILL-TEC™ spikes or HD screws 18" (457 mm) o.c. attachment to concrete decks. Min. 1" (25 mm) shank or thread penetration.
6. Wood nailers attached to gypsum, concrete, cellular concrete and cementitious wood fiber must be fastened 12" (305 mm) o.c., through the nailer into the substrate with substrate approved DRILL-TEC™ fasteners.
7. Three anchors per length of wood nailer minimum.

B. Metal Blocking
1. 20 Ga. galvanized steel box with pre-punched holes and supplied with corrosion-resistant fasteners.
2. Closure and finish strip required for metal decking.
3. Secure in place using provided #14 x 1½-in. universal fasteners through pre-punched holes to roof edge.
4. Install end cap and top of box section with #14 x 1½-in. universal fasteners.

3.04 INSTALLATION – GENERAL

A. Install GAF's EverGuard® TPO roofing system according to all current application requirements in addition to those listed in this section.

B. GAF EverGuard® TPO Specification #: TFANI80

C. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.

3.05 INSULATION

A. GENERAL
1. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder must be repaired.
2. Do not install wet, damaged or warped insulation boards.
3. Insulation boards installed in multiple layers must have the joints between boards staggered in all directions a minimum of 6" (152 mm) between layers.
4. Butt insulation boards together with a 1/4" (6.3 mm) maximum space between adjoining boards. Fit insulation boards around penetrations and perimeter with a 1/4" (6.3 mm) maximum space between board and penetration. Do not kick insulation boards into place.
5. Insulation boards installed over steel decking must have boards placed perpendicular to deck flutes with edges over flute surface for bearing support.
6. Install tapered insulation to provide a sump area a minimum of 36" x 36" (914 mm x 914 mm) where applicable.
7. Wood nailers must be 3-1/2" (8.9 cm) minimum width or 1" (25 mm) wider than metal flange. They shall be of equal thickness as the insulation, and be treated for rot resistance. All nailers must be securely fastened to the deck.
8. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.
9. Insulation should not be installed over new lightweight insulating concrete.

10. Remove and replace insulation boards that become wet or damaged after installation.
11. Pre-drilling is required for concrete decks, and may be required for gypsum concrete and cementitious wood fiber decks.
12. Where insulation is to be adhered in insulation adhesive, adhesion testing is required. The maximum board size for PolyIso roof insulation is 4' x 4'. Gypsum boards and max ½" HD Wood Fiberboard/Perlite may be adhered in 4' x 8 boards except where code requirements supersede.
13. Do not install any more insulation than will be completely waterproofed each day.

3.06 INSULATION – BASE LAYER

A. LOOSE LAID
1. Loose apply the insulation. Minimal fastening should be performed to avoid movement of the boards.

3.07 INSULATION – 2ND LAYER

A. MECHANICALLY ATTACHED
1. The insulation must be securely attached to the roof deck with Drill-Tec™ #12 Fasteners and 3" plates.
2. Fasten using the following pattern:
   a) Field: 8 fasteners per 4' x 8' board
   b) Perimeter: 12 fasteners per 4' x 8' board
   c) Corners: 16 fasteners per 4' x 8' board
3. Use only fasteners with a minimum 3 inch (7.6 cm) stress plate when mechanically attaching insulation. Do not attach insulation with nails.

3.08 INSULATION – 3RD LAYER

A. OLYBOND 500
1. The substrate must be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
2. OlyBond 500 must be applied using the specially designed PaceCart dispenser. OlyBond 500 SpotShot shall be applied using one of the specially designed dual cartridge dispensers. OlyBond 500 Equipment Free Canister System dispenses with 25' hose and gun assembly included with product.
3. Install insulation layers applied with bands of OlyBond 500 to achieve proper coverage rates for insulation attachment:
   a) Field: 12" o.c.
   b) Perimeter: 6" o.c.
   c) Corners: 6" o.c.
4. Approximate coverage rate is ½ to 1 gallon per 100 square feet, depending on the substrate. Allow the foam to rise ¾" to 1". Walk each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6" (15.2 cm) to eliminate continuous vertical gaps.

B. LRF Adhesive XF
1. The substrate must be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
2. Dispense LRF Adhesive XF using supplied canister system in a ribbon pattern to achieve proper coverage rates for insulation attachment:
   a) Field: 12" o.c.
   b) Perimeter: 6" o.c.
   c) Corners: 6" o.c.

3.09 SINGLE PLY MEMBRANE APPLICATION

A. GENERAL
1. Substrates must be inspected and accepted by the contractor as suitable to receive and hold roof membrane materials.
2. Place roof membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent securement.
3. Membrane that has been exposed for more than 12 hours or has become contaminated will require additional cleaning methods.
   a) Light Contamination - Membrane that has been exposed overnight up to a few days to debris, foot traffic, or dew or light precipitation can usually be cleaned with a white cloth moistened with EverGuard® TPO Cleaner (or EverGuard® CleanWeld™ Conditioner, a low-VOC cleaner) for TPO membranes.
   b) Dirt-Based Contamination - Membrane that is dirt encrusted will require the use of a low-residue cleaner, such as Formula 409® and a mildly abrasive scrubbing pad to remove the dirt. This must be followed by cleaning with a white cloth moistened with EverGuard® TPO Cleaner (or EverGuard® CleanWeld™ Conditioner) for TPO membranes.
   c) Exposure-Based Contamination - Membrane that is weathered or oxidized will require the use of EverGuard® TPO Cleaner, EverGuard® CleanWeld™ Conditioner and a mildly abrasive scrubbing pad to remove the weathered/oxidized top surface layer. This must be followed by cleaning with a white cloth moistened with EverGuard® TPO Cleaner (or EverGuard® CleanWeld™ Conditioner) for TPO membranes. Unexposed membrane left in inventory for a year or more may need to be cleaned as instructed above. Be sure to wait for solvent to flash off prior to welding.
   d) Chemical-Based Contamination - Membrane that is contaminated with bonding adhesive, asphalt, flashing cement, grease and oil, and most other contaminants usually cannot be cleaned sufficiently to allow an adequate heat weld to the membrane surface. These membranes should be removed and replaced.

B. Adhered
1. All work surfaces should be clean, dry, and free of dirt, dust, debris, oils, loose and/or embedded gravel, un- adhered coatings, deteriorated membrane, and other contaminants that may result in a surface that is not sound or is uneven.
2. Full-width rolls can be installed throughout the field and perimeter of the roof. Half sheets are not necessary.
3. Overlap roof membrane a minimum of 3" (76 mm) for end laps. For fleece-back membrane, butt ends together and cover joint with 8” (203 mm) wide EverGuard® Flashing Strip heat-welded. Membranes are provided with lap lines along the side laps.
4. Best practice is to install membrane so that the side laps run across the roof slope lapped toward drainage points.
5. All exposed sheet corners must be rounded a minimum of 1" (25 mm).
6. Use full-width rolls throughout the field and perimeter of the roof. Half sheets are not necessary.
7. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
8. Weld shall be a minimum of 1” (25.4 mm) in width for automatic machine welding and a minimum 2” in width for hand welding. Code requirements may supersede these instructions.
9. Roof membrane must be mechanically attached along the base of walls with screws and plates 6” (152 mm) on center.
10. Adhesive should be applied to the membrane at the following rate:
    a) Applied at a total rate of 10 squares (1,000 sq. ft.) per canister equally to both the substrate and the underside of the membrane. Coverage rates may vary depending on the porosity of the substrate.
11. Use appropriate bonding adhesive for substrate surface, applied with a solvent-resistant roller, brush or squeegee.
12. Adhere approximately one half of the membrane sheet at a time. One half of the sheet's length shall be folded back in turn to allow for adhesive application. Lay membrane into adhesive once the bonding adhesive is tacky to the touch.

13. Roll membrane with a weighted roller to ensure complete bonding between adhesive and membrane.
14. Prevent seam contamination by keeping the adhesive application a few inches back from the seam area.
15. Reference the Adhesive securement tables in the EverGuard® Application and Specifications Manuals for substrate adhesion and compatibility.
16. Roll in membrane using a 150 lb. membrane roller or equivalent.
17. To reduce thermal bridging, a full spray of approved Low Rise Foam Adhesive may be used to attach individual insulation layers or adhere the top layer to a mechanically fastened bottom layer.

3.10 FLASHINGS

A. GENERAL
1. All penetrations must be at least 24” (61 cm) from curbs, walls, and edges to provide adequate space for proper flashing.
2. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
3. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non- reinforced membrane.
4. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2” wide (hand welder) weld or minimum 1 - 1/2" automatic machine weld is required.
5. Consult the EverGuard® *Application and Specifications Manual* or GAF Contractor Services for more information on specific construction details, or those not addressed in this section

B. Coated Metal Flashings:
1. Coated metal flashings shall be formed in accordance with current EverGuard construction details and SMACNA guidelines.
2. Coated metal sections used for roof edging, base flashing and coping shall be butted together with a ¼” gap to allow for expansion and contraction. Hot-air weld a 6” wide reinforced membrane flashing strip to both sides of the joint, with approximately 1” on either side of the joint left un-welded to allow for expansion and contraction. 2” wide aluminum tape can be installed over the joint as a bond-breaker, to prevent welding in this area.
3. Coated metal used for sealant pans, scupper inserts, corners of roof edging, base flashing and coping shall be overlapped or provided with separate metal pieces to create a continuous flange condition, and pop-riveted securely. Hot-air weld a 6” wide reinforced membrane flashing strip over all seams that will not be sealed during subsequent flashing installation.
4. Provide a ½” hem for all exposed metal edges to provide corrosion protection and edge reinforcement for improved durability.
5. Provide a ½” hem for all metal flange edges whenever possible to prevent wearing of the roofing and flashing membranes at the flange edge.
6. Coated metal flashings shall be nailed to treated wood nailers or otherwise mechanically attached to the roof deck, wall or curb substrates, in accordance with construction detail requirements.

C. Reinforced Membrane Flashings:
1. The thickness of the flashing membrane shall be the same as the thickness of the roofing membrane.
2. Membrane flashing may either be installed loose or Adhered to the substrate surface in accordance with “Construction Detail Requirements”.
3. Apply the adhesive only when outside temperature is above 40°F. Recommended minimum application temperature is 50°F to allow for easier adhesive application.
4. The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.
5. Please note that solvent-based adhesives must be allowed to dry until tacky to the touch before mating flashing membrane. Water-based adhesive must be allowed to flash off

completely.

6. Heat-weld all laps in EverGuard® smooth-reinforced flashing membrane in accordance with heat-welding guidelines. All seams in fleece-back membrane and smooth field sheet must be stripped in with 8" (203 mm) flashing strip.
7. For extended length guarantees, separate counterflashing is required; exposed termination bars are not acceptable.

D. Un-Reinforced Membrane Flashings:
1. Un-reinforced membrane is used to field-fabricate penetration or reinforcement flashings in locations where preformed corners and pipe boots cannot be properly installed.
2. Penetration flashings constructed of un-reinforced membrane are typically installed in two sections, a horizontal piece that extends onto the roofing membrane and a vertical piece that extends up the penetration. The two pieces are overlapped and hot-air welded together.
3. Apply the adhesive only when outside temperature is above 40°F. Recommended minimum application temperature is 50°F to allow for easier adhesive application. Water-based adhesives are approved for use with smooth TPO membranes for flashings only.
4. The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.
5. Please note that solvent-based adhesives must be allowed to dry until tacky to the touch before mating flashing membrane. Water-based adhesive must be allowed to flash off completely.

E. Roof Edges:
1. Roof edge flashings are applicable for gravel stop and drip edge conditions as well as for exterior edges of parapet walls.
2. Flash roof edges with coated metal flanged edging with a minimum 3" (76 mm) wide flange nailed 4" (102 mm) on center to wood nailers, and heat weld 8” (203 mm) membrane strip to metal flanges.
3. When the fascia width exceeds 4” (102 mm), coated metal roof edging must be attached with a continuous cleat to secure the lower fascia edge. The cleat must be secured to the building no less than 12” (305 mm) o.c.
4. Flash roof edge scuppers with a coated metal insert that is mechanically attached to the roof edge and integrated as a part of the metal edging.
5. Alternatively, roof edges may be flashed with a 2-piece snap on fascia system, adhering the roof membrane to a metal cant and face nailing the membrane 8” (152 mm) on center prior to installing a snap-on fascia.
   a) Submit design drawings for review and approval to Architect or Specifier before fabrication.
   b) Installing contractor shall check as-built conditions and verify the manufacturer’s roof edging details for accuracy to fit the wall assembly prior to fabrication. The installer shall comply with the roof edging manufacturer’s installation guide when setting edging.

F. Parapet and Building Walls:
1. Flash walls with EverGuard® TPO membrane adhered to the substrate with bonding adhesive, loose applied or with coated metal flashing nailed 4” (102 mm) on center to pressure-treated wood nailers.
2. Maximum flashing height without intermediate fastening is 24" (610 mm) for loose-applied flashing and 54" (1.4 m) for adhered flashing
3. Secure membrane flashing at the top edge with a termination bar. EverGuard® Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars must be mechanically fastened 6” (152 mm) o.c. (20-year max. guarantee); termination bars that are counter flashed must be fastened 12” (305 mm) o.c.
4. Exposed termination bars must be sealed with Flexseal™ Caulk Grade Sealant.
5. Roof membrane must be mechanically attached along the base of walls with screws and plates 12” (305 mm) on center [6” (152 mm) on center for Ballasted Systems]
6. Metal cap flashings must have continuous cleats or be face fastened 12" (305 mm) o.c. on both

the inside and outside of the walls.
7. Flash wall scuppers with a coated metal insert that is mechanically attached to the wall and integrated as part of the wall flashing.
8. Roof Transition Anchor (R.T.A.) Strip may be installed as the alternate method of base securement for a RhinoBond® non-penetrating base attachment detail.

G. Curbs and Ducts:
1. Flash curbs and ducts with EverGuard® TPO membrane adhered to the curb substrate with bonding adhesive, loose applied or with coated metal flashing nailed 4” on center to pressure-treated wood nailers.
2. Maximum flashing height without intermediate fastening is 24" (610 mm) for loose-applied flashing and 54" (1.4 m) for adhered flashing
3. Secure membrane flashing at the top edge with a termination bar. EverGuard® Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened 6” (152 mm) on center for guarantees less than 20 years and 12” (305 mm) on center for guarantees greater than 20 years or that are counter-flashed.
4. Exposed termination bars must be sealed with Flexseal™ Caulk Grade Sealant.
5. Roof membrane must be mechanically attached along the base of walls with screws and plates 12” (305 mm) on center [6” (152 mm) on center for Ballasted Systems]
6. Metal counterflashings may be optional with Adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with Flexseal™ Roofing Cement.
7. All coated metal curb flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.

H. Roof Drains:
1. Roof drains must be fitted with compression type clamping rings and strainer baskets. Original-type cast iron and aluminum drains, as well as retrofit-type cast iron, aluminum or molded plastic drains are acceptable.
2. Roof drains must be provided with a minimum 36” x 36” sump. Slope of tapered insulation within the sump shall not exceed 4” in 12”.
3. Extend the roofing membrane over the drain opening. Locate the drain and cut a hole in the roofing membrane directly over the drain opening. Provide a ½” of membrane flap extending past the drain flange into the drain opening. Punch holes through the roofing membrane at drain bolt locations.
4. For cast iron and aluminum drains, the roofing membrane must be set in a full bed of water block on the drain flange prior to securement with the compression clamping ring. Typical water block application is one
10.5 ounce cartridge per drain.
5. Lap seams shall not be located within the sump area. Where lap seams will be located within the sump area, a separate roof membrane drain flashing a minimum of 12” larger than the sump area must be installed. The roof membrane shall be mechanically attached 12” on center around the drain with screws and plates. The separate roof drain flashing shall be heat welded to the roof membrane beyond the screws and plates, extended over the drain flange, and secured as above.
6. Tighten the drain compression ring in place.

I. Expansion Joints:
1. Any prefabricated expansion joint metal nailing strips must be fastened to wood nailers, curbs or secured to walls with appropriate nails or DRILL-TEC™ Fasteners.
2. Roof membrane must be mechanically attached along the base of raised curb-expansion joints with screws and plates a minimum of 12" (305 mm) o.c. The expansion joint cover bellows shall be at least 2 times the expansion joint opening.
3. Metal nailing strip must be set in FlexSeal™ Caulk Grade Sealant and secured with fasteners and neoprene washers fastened 6" (152 mm) o.c
4. Expansion joints may be field fabricated. Reference appropriate Construction Detail.

J. Scuppers:
   1. Coated-metal roof-edge scuppers must be provided with a min. 4" (102 mm) wide flange nailed to wood nailers, with hemmed edges and secured with continuous clips in accordance with the gravel stop assembly.
   2. Coated-metal wall scuppers must be provided with 4" (102 mm) wide flanges, with additional corner pieces pop-riveted to the flanges to create a continuous flange. All flange corners must be rounded.
   3. Install wall scuppers over the roof and flashing membrane and secure to the roof deck/wall with DRILL- TEC™ Fasteners 6" (152 mm) o.c., a minimum of 2 fasteners per side.
   4. All corners must be reinforced with EverGuard® PVC or EverGuard® TPO Universal Corners or field- fabricated from EverGuard® non-reinforced materials.
   5. Strip-in scupper with flashing membrane target sheet.
   6. Alternately, a wall scupper box may be field-flashed using non-reinforced flashing membrane heat-welded to membrane on the wall face and roof deck. Fully adhere to the scupper box and terminate on the outside wall face with a termination bar and FlexSeal™ Caulk Grade sealant.
   7. EverGuard® TPO has prefabricated scuppers in standard and custom sizes available

K. Wood Support Blocking:
   1. Wood support blocking, typically 4" x 4" (102 mm x 102 mm), is usually installed under light-duty or temporary roof-mounted equipment, such as electrical conduit, gas lines, condensation, and drain lines.
   2. Install wood support blocking over a protective layer of EverGuard® TPO walkway rolls or PVC walkway pads. Place wood blocking on oversized slip sheet, fold two sides vertically, and fasten with roofing nails into the blocking.

3.11 TRAFFIC PROTECTION

A. Install walkway rolls at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.

B. Walkway pads must be spaced 6" apart to allow for drainage between the pads.

C. Heat-weld walkway rolls to the roof membrane surface continuously around the perimeter of the roll.

3.12 ROOF PROTECTION

A. Protect all partially and fully completed roofing work from other trades until completion.

B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.

C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.

D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.13 CLEAN-UP

A. All work areas are to be kept clean, clear and free of debris at all times.

B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.

C. All tools and unused materials must be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.

D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.

E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.

F. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIAL

A. Hot-dipped Galvanized Steel for use as counterflashings (where not visible from the ground), pitch pans and expansion joints: Minimum 24-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A 525.

B. Hot-dipped Galvanized Steel for use as continuous clips: Minimum 22-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A 525.

C. Prefinished Galvanized Sheet Steel (where visible from the ground): Shall be 24-gauge flat stock, prefinished with Kynar finish meeting ASTM A 446, forty-five and one-half inches to forty-eight inches width by one hundred twenty inches in length (45-1/2" - 48" x 120") for use as new metal edge gravel guard, downspouts, gutters, coping and miscellaneous metal. Standard color to be selected by Owner/Project Consultant.

D. TPO Cladded Metal: Shall be G-90 galvanized steel with 25 mil TPO membrane lamination; width shall be four feet, length shall be eight or ten feet. Standard color to be selected by Owner.

E. Stainless Steel: QQ-S-766, Class 301, 302, 304, or 316; or ASTM A 167, Type 301, 302, 304, or 316; form and condition most suitable for the purpose.

F. Aluminum and Aluminum Alloy Plate and Sheet: QQ-A-250; form, alloy, and temper shall be that most suitable for the purpose.

G. Sheet Lead: QQ-L-201, Grade B.

H. All existing sheet metal shall be replaced with new metal of like gauge and type, or as specified on drawings.

2.2 FASTENERS

A. Fasteners shall be same metal as flashing/sheet metal, or other non-corrosive metal as recommended by sheet manufacturer for the specific application. Match finish of exposed heads with material being fastened.

B. Fasteners and fastening plates or bars shall be listed in the FM Global Approval Guide.

C. Fastener for Brick: Shall be one-fourth inch by two inches (1/4" x 2"), zinc with plated steel or stainless steel nail, one piece unit, flat head.

D. Screws: Self-taping sheet metal type with neoprene washer, as appropriate.

E. Pop Rivets: Full stainless steel Series 42 or 44, as appropriate.

F. Continuous Clip: Concealed hold-down clip type; of same materials as coping, gravel guard, sized to suit application. Use a continuous clip, minimum 20-gauge G-90 galvanized.

2.3 RELATED MATERIAL

A. Bituminous Paint: Acid and alkali resistant, black color.

B. Plastic Cement: FS SS-C-153, cutback asphalt type.

C. Solder: QQ-S-571 composition best suited for purpose; use high tin content, minimum 60/40, for stainless steel and monel alloy.

D. Copper, Sheet, and Strip: QQ-C-576, ASTM B 370, light cold-rolled temper.

E. Lead-coated Copper: ASTM B 101, Type I or II, Class A.

F. Sealant (for Sheet Metal): One-component polyurethane, conforming to requirements of FS TT-S-230C, non-staining and non-bleeding.

G. Miscellaneous Materials:
   1. Downspout Boots: Cast iron by Neenah Foundry Company, or pre-approved equal, provide and install.
   2. Splash Blocks: Concrete, 3000 psi, 28 days. Provide and install with protection pads at all downspouts. Dimensions shall be a minimum eighteen inches wide by thirty-six inches long (18" x 36").
   3. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size, and gauge required for performance.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, substrates are smooth and clean and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed and secure.

C. Beginning of installation means acceptance of conditions.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating work. Provide all shop drawings and mock-ups one month prior to installation to the Owner/Project Consultant for approval.

B. Install starter and edge strips and cleats before starting installation.

3.3 FABRICATION - GENERAL

A. Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer's instructions and recommendations. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.

B. Fabricate gravel stops/fascia, gutters/downspouts, counterflashings, pitch pans, expansion joints, and copings with new galvanized sheet metal as specified. Fabricate gravel guard and fascia to size and dimensions as indicated on the drawings. Fabricate light metal coping, gutters and downspouts as indicated.

C. Form sheet metal on bending brake.

D. Shape, trim and hand seam metal on bench insofar as practicable.

E. Form materials with straight lines, sharp angles and smooth curves.

F. Fold back edges on concealed side of exposed edge to form hem (1/2" minimum).

G. Weld or solder joints on parts that are to be permanently and rigidly assembled.

H. Submit sheet metal models for approval by the Owner/Project Consultant.

I. Limit single-piece lengths to ten feet (10').

J. Fabricate corner pieces with eighteen inch (18") extensions, metered and sealed by forming as one piece.

K. Surface sand flange prior to applying any primers on Kynar metal.

L. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint.

M. All existing or missing metal rooftop projections shall be replaced. New rooftop projection details shall be as recommended in NRCA or SMACNA handbooks. All rooftop projections shall be cleaned, all joints sealed, and painted with a rust inhibitive paint. Standard color to be selected by the Owner/Project Consultant.

N. All sheet metal shall be sealed and watertight.

O. Metal work should be secured so as to prevent damage from buckling or wind. Where clips are shown, these are to be continuous.

P. All metal to receive bitumen or adhesive shall be first primed with asphalt primer.

Q. All prefinished metal shall be sanded and/or abraded prior to receiving primer.

R. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges are to be seamed, form seams, and solder.

S. Expansion Provisions: Form expansion joints of intermeshing hooked flanges, not less than one inch (1") deep, filled with mastic sealant (concealed within joints).

T. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with industry standards.

U. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

V. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

3.4 INSTALLATION

A. General: All sheet metal termination to vertical wall shall have a through-wall with receiver installed on masonry walls or prefabricated "Z" bar flashing pre-installed to fluid applied wall finished prior to installation of sheet metal termination. This applies to edge metal, base flashing closures and all vertical surface intersections. Refer to NRCA, SMACNA, and metal manufacturer's guidelines.

B. TPO cladded metal shall be fabricated as needed; follow these specifications and standard sheet metal practice for attachment to roof details.

C. Gravel Guard/Fascia:
1. Shall be installed with expansion joints, ten feet (10') on center, one-fourth inch (1/4") expansion leeway, with a cover plate.
2. Secure metal flashings per specifications.
3. Lock seams and end joints.
4. Form sections identical to profiles as shown or approved similar, to match existing building.
5. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
6. Hem exposed edges three-fourths inch (3/4") minimum.
7. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
8. Integrate flashing in a manner consistent with detailing.
9. Provide and install continuous clip around perimeter.
10. Shall be fabricated in accordance with all SMACNA provisions.

D. Coping:
1. Remove existing and replace with new metal coping as required for a permanent watertight installation.
2. All coping shall be manufactured with low profile standing seam metal to meet ES-1.
3. Shall be minimum 24-gauge prefinished Kynar installed in ten foot (10') sections maximum.
4. Vertical fascia shall extend minimum two and one-half inches (2-1/2") or be minimum one and one-half inches (1-1/2") below bottom of nailer, whichever is greater.
5. Secure metal flashings per specifications.
6. Lock seams and end joints.
7. Form sections identical to profiles as shown or approved similar, to match existing building.
8. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
9. Hem exposed edges three-fourths inch (3/4") minimum.
10. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
11. Integrate flashing in a manner consistent with detailing.
12. Provide and install continuous clip, minimum 22-gauge.
13. Shall be fabricated in accordance with all SMACNA provisions.

E. Expansion Joint Field and at Wall:

1. Shall be as outlined by details, and be in full compliance with all provisions of SMACNA and FM Global requirements for attachment, installation and recommendations.
2. Secure metal flashings per specifications.
3. Lock seams and end joints.
4. Form sections identical to profiles as shown or approved similar, to match existing building.
5. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
6. Hem exposed edges three-fourths inch (3/4") minimum.
7. Backpaint flashing in contact with masonry or dissimilar materials with bituminous paint. Surface sand before applying primers.
8. Integrate flashing in a manner consistent with detailing.
9. Provide and install continuous clip around perimeter.
10. Shall be fabricated in accordance with all SMACNA provisions.

F. Counterflashing:
1. Remove existing and replace with new metal counterflashing as required for a permanent watertight installation.
2. Saw cut brick mortar joint to receive friction fit reglet and removable counterflashing as detailed in SMACNA Figure 4-3E.

G. Gutter and Downspout:
1. Fabrication:
   a) Fabricate gutter and downspout of profile and size indicated.
   b) Field measure site conditions prior to fabricating work.
   c) Fabricate with required connection pieces.
   d) Fabricate section square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.
   e) Hem exposed edges of metal.
   f) Form and seal all metal joints; provide for expansion joints per SMACNA.
2. Installation:
   a) Install collector head, downspout, and accessories.
   b) Join lengths with seams pop riveted and sealed watertight. Flash and seal collector head to downspouts and accessories.
   c) Seal all metal joints watertight for full metal surface contact.
   d) Collector Head: SMACNA style profile; submit detail for approval.
   e) Downspouts: Rectangular profile. Seal all joints, four inches by six inches (4" x 6").
   f) Support Brackets, Joint Fasteners: Profiled to suit gutters and downspouts.
   g) Anchorage Devices: SMACNA requirements. Type recommended by fabricator.
   h) Collector Head Support: Kynar. Color and Finish to match, as recommended by SMACNA.
   i) Downspout Supports: Straps, Kynar. Color and Finish to match.

H. Overflow Scupper, Collector Head and Downspout:
1. Fabrication:
   a) Fabricate overflow scupper, collector head and downspout of profile and size indicated, taking care that the roof drain leader fits properly into the back of the collector head. Seal the pipe to the collector head for watertightness.
   b) Field measure site conditions prior to fabricating work.

c) Fabricate with required connection pieces.
d) Fabricate section square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.
e) Hem exposed edges of metal.
f) Form and seal all metal joints; provide for expansion joints per SMACNA.

2. Installation:
   a) Install collector head, downspout, and accessories.
   b) Join lengths with seams pop riveted and sealed watertight. Flash and seal collector head to downspouts and accessories.
   c) Seal all metal joints watertight for full metal surface contact.
   d) Collector Head: SMACNA style profile; submit detail for approval.
   e) Downspouts: Rectangular profile. Seal all joints, four inches by six inches (4" x 6").
   f) Support Brackets, Joint Fasteners: Profiled to suit gutters and downspouts.
   g) Anchorage Devices: SMACNA requirements. Type recommended by fabricator.
   h) Collector Head Support: Kynar. Color and Finish to match, as recommended by SMACNA.
   i) Downspout Supports: Straps, Kynar. Color and Finish to match.

I. Pitch Pans:
1. Install pitch pans of 24-gauge, G-90 galvanized steel with a 25 Mil TPO membrane lamination according to NRCA standards, minimum of six inches by six inches (6" x 6").
2. Pitch pans shall be fabricated to a minimum of six inches (6") above the finished roof membrane. The top vertical edge of the thermoplastic clad metal must be folded over to conceal the uncoated side of the metal inside the pitch pan. The pitch pan flange must be a minimum of three and one half inches (3.5”) wide in contact with the horizontal roof plain or field of roof membrane.
3. Approved caulking or water block shall be applied under the pitch pan flange prior to securing the flange to the deck with approved fasteners a minimum of 4” on center.
4. All projections enclosed in pitch pans shall be cleaned in any manner suitable and coated with a rust inhibitive coating as approved by the Owner/Project Consultant. Coating shall be allowed to dry prior to pitch pan fill.
5. Base of pitch pans shall be filled with grout or cementitious binder to proper height and allowed to cure.
6. Top finish fill shall be self-leveling, one-part urethane, with maximum fill to within three- eighths inch (3/8") of top of pitch pan sides.
7. Strip the thermoplastic clad metal flange of the pitch pan to the field membrane with one strip of flashing membrane. The flashing membrane must extend from the outer edge of the pitch pan flange onto the field membrane a minimum of three inches (3") and butt to the vertical sides of the pitch pan on all 4 sides. The flashing membrane shall be hot air welded to the thermoplastic clad metal pitch pan and to the field membrane. Hot air welds shall be a minimum of two inches (2”) wide.
8. Install preformed outside corners by hot air welding in place at all four (4) corners of the pitch pan.
9. Apply seam sealer to the edges of the flashing membrane.

J. Bonnets/Hoods:
1. Fabricate and install above all pitch pans, where necessary, or reinstall as applicable, metal bonnets over all pitch pans, NO EXCEPTIONS.
2. Bonnets/Hoods shall be manufactured with metal compatible with metal to

which bonnet is to be attached.

3. On beams and other steel weld in place bonnets fabricated from one-fourth inch (1/4") steel plate.
4. Draw band bonnets fabricated from 22-gauge galvanized steel may be used on circular projections.

3.5 FINISH

A. Backpaint concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Exposed surfaces to be provided with a factory applied fluorocarbon Kynar finish meeting ASTM A 446 and AAMA specification 605.2 for high performance coating.

B. New 24-gauge hot-dipped galvanized metal shall be painted on all locations visible from the ground with an industrial grade paint to match existing, or standard color selected by Owner/Project Consultant. Galvanized metal surface must be properly prepared by removing all oil, grease, and/or protective mill coatings by solvent cleaning surface in accordance with SSPC-SP1, and according to paint manufacturer's recommendation, to ensure proper adhesion of paint to metal.

3.6 FIELD QUALITY CONTROL

A. Quality Assurance Inspections: Sheet metal materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.

END OF SECTION 07 62 00

SECTION 077233

ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data.

B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years experience manufacturing similar products.

B. Installer: A minimum of 2 years experience installing similar products.

C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer: Type S Roof Hatch by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-535-1582, Web: www.BILCO.com.

2.2 ROOF HATCH WITH SAFETY CAGE

A. Furnish and install where indicated on plans metal roof hatch Type S, size width: 36" (914mm) x length: 30" (762mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

B. Performance characteristics:

1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m^2) with a maximum deflection of 1/150th of the span and a maximum design pressure of +/- 100 PSF (488 kg/m^2) with a design factor of 2 for galvanized steel (Type S-20) and aluminum (Type S-50) roof hatches or 20 psf (97 kg/m^2) for stainless steel (Type S-90) roof hatches or roof hatches with an aluminum cover and galvanized steel curb (Type S-40)].
2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
5. Galvanized steel (Type S-20) and aluminum (Type S-50) roof hatches shall have a valid Notice of Acceptance (NOA) by Miami-Dade County Product Control Section. The hatches shall have product approval (FL) by Florida Building Council regarding compliance to Florida Building Code.

C. Cover: Shall be [select: 14 gauge (1.9mm) galvannealed steel or 11 gauge (2.3mm) aluminum] with a 3” (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be fiberglass of 1” (25mm) thickness, fully covered and protected by a metal liner [select: 22 gauge (.8mm) galvannealed steel or 18 gauge (1mm) aluminum].

E. Curb: Shall be 12” (305mm) in height and of [select: 14 gauge (1.9mm) galvannealed steel or 11 gauge (2.3mm) aluminum]. The curb shall be formed with a 3-1/2” (89mm) flange with 7/16” (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6” (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

F. Curb insulation: Shall be rigid, high-density fiberboard of 1” (25mm) thickness on outside of curb.

G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe [for aluminum construction: welded to the curb assembly; for steel construction: through bolted to the curb assembly].

H. Hardware

1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with a spring latch with interior and exterior turn handles
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1” (25mm) diameter red vinyl grip handle to permit easy release for closing.

6. All hardware shall be zinc plated and chromate sealed. [For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, specify Type 316 stainless steel hardware].
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. Finishes: Factory finish shall be [mill finish aluminum].

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.

1. Test units for proper function and adjust until proper operation is achieved.
2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION

SECTION 07 81 16

CEMENTITIOUS

FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Direct-to-steel fireproofing sprayed on shop primed steel members, galvanized floor deck, and galvanized roof deck, as scheduled. Material and installation shall conform to the applicable building code requirements of all authorities having jurisdiction.

B. Related Sections:
1. Section 01 45 23 - Testing and Inspection Services.
2. Section 05 12 00 - Structural Steel.
3. Section 05 21 00 - Steel Joists & Joist Girders.
4. Section 05 31 00 - Steel Deck.
5. Section 09 21 16 - Gypsum Board Assemblies: gypsum wallboard fireproofing.

1.2 SUBMITTALS

A. Fireproofing Design: Submit copies of each UL Design selected for each required fire resistance rating, including an applicator's certification that each UL Design selected will provide the scheduled fire resistance rating in accordance with the referenced building code.

B. Certificates:
1. Provide manufacturer's certification or independent test reports confirming that installed materials meet or exceed performance criteria specified.
2. Provide reports from reputable independent testing agencies, of product proposed for use, which indicate conformance to ASTM E 84 and E 119.
3. Provide manufacturer’s certification that UL Designs selected for the project are not load restricted.

C. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit manufacturer's literature of products furnished, including application instructions.

D. Thickness Schedule: Provide schedule indicating material to be used, building elements to be protected with spray-applied fireproofing, hourly rating, and material thickness provided and appropriate references.

1.3 QUALITY ASSURANCE

A. Applicator: Work shall be performed by a firm acceptable to the cementitious fireproofing material manufacturer.

B. Requirements of Regulatory Agencies:
1. Underwriters' Laboratories, Inc.: Products, execution, and thickness shall conform to approved UL Designs as published in UL Fire Resistance Directory.
2. Testing: Sprayed fireproofing designs shall be as tested and certified to attain specified fire resistance ratings in accordance with ASTM E 119.
3. Local Building Code: Fireproofing material shall have approval of governing code authorities for this building's materials and designs.

C. Pre-installation Conference: Conduct conference at project site. Contractor, fireproofing subcontractor, and independent testing laboratory shall attend a pre-installation conference to

review the substrates for acceptability, method of application, applied thicknesses, inspection procedures, and other issues.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with legible and intact manufacturers' labels identifying products. Include on labels names of products, manufacturers, and date of manufacture. Also include UL labels for fire-resistance ratings applicable to project.

B. Store materials inside, under cover, above ground and in a manner to keep them dry until ready to use. Remove from project site and discard materials that have been exposed to moisture or have otherwise deteriorated.

1.5 PROJECT CONDITIONS

A. Environmental Conditions: Do not install sprayed-on fireproofing when ambient or substrate temperatures are 40°F. and falling. A minimum air and substrate temperature of 40°F. must be maintained during and for 24-hours after application of the spray-applied fireproofing.

B. Protection:
1. Provide ventilation in area to receive fireproofing. Provide ventilation in poorly ventilated areas to achieve a total air exchange rate of 4 times per hour until the material is substantially dry.
2. Provide temporary enclosures to prevent spray from contaminating air or adjacent property.
3. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting-off of fireproofing.

1.6 SEQUENCING

A. Coordinate installation with other work to avoid cutting and patching of installed fireproofing.
1. Clips, hangers, clamps, sleeves, stops, and other attachments to the substrate shall be installed prior to application of fireproofing.
2. Concrete work on steel floor decking shall be completed prior to application of fireproofing to the underside of the deck.
3. Roofing system, including rigid insulation system on decking, shall be completed prior to application of fireproofing to the underside of the deck.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Sprayed-on Cementitious Fireproofing;
product/manufacturer: Monokote MK-6; Construction Products Div., W.R. Grace & Co. Cafco BlazeShield II; Isolatek International
Pyrolite No. 15; Carboline Company - Fireproofing Products Division.

B. Bonding Agent; Product/Manufacturer:
Fire Bond; Grace Construction Products Div., or approved equivalent.

2.2 SPRAYED-ON FIREPROOFING MATERIALS

A. General: Provide manufacturer's standard applications of standard products complying with requirements indicated below for material composition and physical properties representative of installed products.

B. Material Composition: Cementitious Fireproofing consisting of factory-mixed, dry formulation mixed with water at project site to form a slurry or mortar for pumping and for dispersal by compressed air introduced at spray nozzle. Cement-aggregate formulation, chloride free,

composed of Portland cement, additives, and inorganic aggregates. NOTE: Mineral Fiber fireproofing will not be permitted.

C. Physical Properties of Fireproofing: Minimum values, unless otherwise indicated or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property listed below:
   1. Bond Strength: 200 lbf. per sq. ft. per ASTM E 736.
   2. Compressive Strength: 8.3 lbf. per sq. ft. per ASTM E 761.
   3. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
   4. Deflection: No cracking, spalling, delamination or the like per ASTM E 759.
   5. Effect of Impact on Bonding: No cracking, spalling, delamination or the like per ASTM E 760.
   6. Air Erosion: Maximum weight loss of 0.000 grams per sq. ft. in 24 hours per ASTM E 859.
   7. Dry Density: 15 pcf for average and individual densities as required for fire-resistance rating indicated, per ASTM E 605.
   8. Surface Burning Characteristics: ASTM E 84.
      a. Flame Spread: 0
      b. Smoke Developed: 0

D. Water: Clean, potable.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces to receive fireproofing shall be free of mill scale, dirt, oil, grease, dust, loose rust, paint or other foreign substances which may impair proper adhesion of the fireproofing to the substrate.

B. Cleaning shall be accomplished just prior to the application of fireproofing.

C. Do not apply fireproofing to surfaces which cannot be corrected by normal cleaning methods. Correct condition before applying fireproofing..

D. Cover other work subject to damage from fall-out or overspray of fireproofing materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintaining adequate ambient conditions for temperature and ventilation.

E. Complete placing of concrete on floor and roof decking prior to application of the fireproofing to the underside of steel deck and supporting beams and joists.

F. On roof decks without a concrete cover, complete all roofing applications and roof mounted equipment installation prior to application of the fireproofing to the underside of roof decking and supporting beams and joists. Prohibit all roof traffic upon commencement of the fireproofing and until the fireproofing material is dry.

G. Commencement of application of fireproofing shall be interpreted as acceptance by the applicator of the suitability of the surface to receive fireproofing material and acceptance of responsibility for failure of bond between fireproofing and steel

3.2 APPLICATION

A. Apply fireproofing in accordance with manufacturer's recommendations for mixing materials, application procedures, and types of equipment used to convey and spray on fireproofing materials; as particular conditions of installation and as required to comply with fire rating requirements and approved UL Designs indicated.

B. Spray apply with as many coats as necessary to obtain required thickness and uniform density.

C. Completely cover members designated to be fireproofed.

D. Install metal lath, as required, to comply with fire-resistance ratings and recommendations of fireproofing manufacturer for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fireproofing. Use anchorage devices of type recommended by fireproofing manufacturer. Attach lathing accessories where indicated or required.

E. Post appropriate cautionary "Slippery When Wet" signs in all areas in contact with wet fireproofing material. Erect appropriate barriers to prevent entry by non-fireproofing workers into the fireproofing spray and mixing areas and other areas exposed to wet fireproofing material.

3.3 FIELD QUALITY CONTROL

A. Field testing will be performed in accordance with SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

B. Testing laboratory shall sample and verify the bond strength, thickness and density of the fireproofing in accordance with the provisions of ASTM E 605, ASTM E 736, and Chapter 17 of the applicable building code.

C. Re-testing required as a result of non-conforming work shall be paid for by the Contractor.

3.4 PATCHING

A. Inspect members for complete coverage, correct unacceptable work, and patch. Chip out areas which are defective or do not bond. Clean steel surface and reapply fireproofing.

B. Patch areas damaged or cut by other work. Patch area from which test samples are taken.

3.5 CLEANING, REPAIR, AND PROTECTION

A. Remove equipment. Immediately after completing spraying operations in each containable area of project, remove material over-spray and fall-out from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Cure exposed cementitious fireproofing materials according to fireproofing manufacturer's recommendations to prevent premature drying.

C. Protect fireproofing, according to advice of fireproofing manufacturer and Installer, from damage resulting from construction operations or other causes so that fireproofing will be without damage or deterioration at time of substantial completion.

D. Coordinate installation of fireproofing with other construction to minimize the need to cut or remove fireproofing. As installation of other construction proceeds, inspect fireproofing and patch any areas where fireproofing was removed or damaged.

E. Repair or replace work that has not been successfully protected.

END OF SECTION

SECTION 07 81 23

INTUMESCENT

FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exposed intumescent fire-resistive coatings, exterior and interior applications.

B. Related Sections:
   1. Section 01 45 23 - Testing and Inspection Services.
   2. Section 05 12 00 - Structural Steel.

1.2 SUBMITTALS

A. Fireproofing Design: Submit copies of each UL Design selected for each required fire resistance rating, including an applicator's certification that each UL Design selected will provide the scheduled fire resistance rating in accordance with the referenced building code.

B. Product Data: For each type of product indicated.

C. Product Certificates: Submit product certificate for intumescent fireproofing, signed by product manufacturer.

D. LEED Submittals:
   1. Product Data: For paints and coatings, indicating VOC content.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its intumescent fireproofing to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Fire-Test-Response Characteristics: Provide intumescent fireproofing with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's Fire Resistance Directory.
   2. Surface-Burning Characteristics: ASTM E 84.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to project.

B. Use materials with limited shelf life within period indicated. Remove from project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from project site and discard wet or deteriorated materials.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply intumescent fireproofing when ambient or substrate temperature is 50° F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

PART 2 - PRODUCTS

2.1 EXPOSED INTUMESCENT FIRE-RESISTIVE COATINGS

A. VOC Content: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 50 g/L.
   3. Primers, Sealers, and Undercoaters: 100 g/L

B. Low-Emitting Materials: For field applications, coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Asbestos: Provide products containing no detectable asbestos.

D. Exposed Interior Areas: Acceptable Manufacturers: Provide one of the following: A/D Fire Protection Systems Inc.; Firefilm II and Colorcoat.
   Albi Manufacturing, Division of StanChem Inc.; Albi Clad TF.
   Carboline Company, Fireproofing Products Div.; Thermo-Sorb

E. Color and Gloss: As selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
   1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
   2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
   3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.

B. Prime substrates where recommended in writing by intumescent fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive.

C. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of intumescent fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

A. Comply with fire-resistive material manufacturer's written instructions for application procedures, and types of equipment used to convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Extend fire-resistive material in full thickness over entire area of each substrate to be protected.

C. Apply exposed intumescent fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.

D. Apply intumescent fire-resistive coating as follows:
   1. Install reinforcing fabric as required to obtain designated fire-resistance rating.
   2. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities and to seal in surface fibers.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

3.5 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after application of intumescent fireproofing clean exposed surfaces to remove evidence of soiling.

B. Protect intumescent fireproofing from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.

C. Repair or replace work that has not successfully protected steel.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Firestopping for all fire-rated construction complete, including, but not limited to:
   1. Firestopping in conjunction with gypsum board, masonry and plaster partitions.
   2. Firestopping shall include, but not be limited to the following applications:
      a. Sealing gaps between tops of partitions and roof/floor decks.
      b. Sealing gaps between structure and glass curtainwalls with fire safing insulation.
      c. Other locations where "firestopping", "firestop", or "safing" is indicated.
      d. Where required by codes.
      e. Control joints and expansion joints in masonry or gypsum board fire-rated partitions.
      f. Expansion joints in roof and floor assemblies.

B. Related Sections:
   1. Section 07 21 00 - Building Insulation.
   2. Section 07 92 00 - Joint Sealants.
   3. Section 09 21 16 - Gypsum Board Assemblies.
   4. Divisions 23 and 26.

1.2 SUBMITTALS

A. Refer to SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit copies of manufacturer's literature. Include data substantiating that materials comply with specified tested system requirements.

C. Samples: Submit duplicate samples of each type of firestopping material and accessories.

D. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgement derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgement drawings must follow requirements set forth by the International Firestop Council.

E. LEED Submittal
   1. Product Data: For sealants, indicating VOC content.
   2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Do not allow firestopping materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection.

1.4 PROJECT CONDITIONS

A. Do not install firestopping materials until building is completely enclosed and weathertight.

B. Coordinate installation with the work of other trades. Reference SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

PART 2 - PRODUCTS

2.1 PRODUCT/MATERIAL PERFORMANCE REQUIREMENTS

A. Exposed Firestopping Systems:
   1. Sealant shall have a VOC content of 250 g/L or less.
   2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Except as otherwise indicated, firestop materials shall be classified in the Underwriters Laboratories (UL) Building Materials Directory, "Section XHEZ-Through-Penetration Firestop Systems", and/or "Section XHHW-Fill Void or Cavity Materials", and “Section XHBN - Joint Systems” for specific project conditions:
   1. Time rating ("F", Fire and "T", Temperature) (T-rating is only required for construction joint systems).
   2. Floor or wall assembly and material.
   3. Penetrating materials/items diameters, or void space.
   4. Through opening size.
   5. Annular space between penetration opening and penetrating item.

C. Firestopping materials shall provide a fire-rating commensurate with the adjacent construction rating.

D. Firestop materials shall comply with ASTM E 84: Surface Burning Characteristics.

E. Firestop materials shall have been tested in accordance with ASTM E 814, UL 1479 or UL 2079.

F. Firestop materials shall be free of asbestos.

G. Firestop materials shall be paintable or capable of receiving finish materials in those areas which are exposed to view and which are scheduled to receive finishes.

H. Obtain firestop products from a single manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine substrate and conditions under which firestopping work is to be performed, and notify Contractor in writing of any unsatisfactory conditions.

3.2 INSTALLATION

A. Install firestopping materials including foaming, packing and accessory materials to fill openings around penetrations in floors and walls, to seal gaps between decks and partitions, gaps between structure and curtainwall, etc., to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Use silicone based materials for all wet or damp conditions.

B. Install firestop materials and systems in accordance with manufacturer's printed instructions and applicable UL Building Materials Directory assemblies.

C. Cut and friction fit fire safing type insulation firestopping to completely fill all gaps and voids. Provide stick- clips, sheet metal closures, and any other accessories to support insulation.

D. Where floor openings are 4" or more in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.

E. Remove damming materials after curing if made of other than fire resistant materials.

F. Protect materials from damage on surfaces subject to traffic.

3.3 FIELD TESTING

A. Firestop materials and installation may be tested by an independent testing laboratory. Refer to SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

3.4 CLEAN UP

A. Clean up all debris caused by the work of this Section, keeping the premises clean and neat at all times.

B. Clean adjacent surfaces soiled by the work of this section.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sealing and caulking of joints.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 03 47 00 - Site-Cast Concrete
3. Section 04 73 25 – Thin Masonry Stone Veneer (Adhered)
4. Section 06 40 00 - Architectural Woodwork.
5. Section 07 24 19 – Exterior Insulation and Finish System (EIFS)
6. Section 07 62 00 - Sheet Metal Flashing and Trim.
7. Section 07 84 00 - Firestopping.
8. Section 08 80 00 - Glazing.
9. Section 09 21 16 - Gypsum Board Assemblies.
10. Section 01 91 19 - Building Envelope Commissioning
11. Section 07 05 23 - Pressure Testing the Air Barrier System for Air Tightness

1.2 SUBMITTALS

A. Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, color availability and application instructions.

C. Submit two samples ¼" diameter x 4" in size illustrating color selections available.

D. Submit manufacturer's certificate under provisions of SECTION 01 45 00 - QUALITY CONTROL that products meet or exceed specified requirements.

E. LEED Submittals:
1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.

B. Applicator: Company specializing in applying the work of this section with minimum 3 years documented experience and approved by sealant manufacturer.

C. Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.4 FIELD SAMPLES

A. Provide samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Construct one field sample joint, 5 feet long, illustrating sealant type, color, and tooled surface.

C. Locate where directed.

D. Accepted sample may remain as part of the work.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: No caulking shall be done at temperatures below 40°F.

1.6 WARRANTY

A. Furnish to the Owner a written warranty that the sealants shall remain watertight for a period of 2 years from the date of acceptance of the building. Joints which prove defective by leaking, cracking, melting or shrinking of the sealant shall be re-sealed without additional expense to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reference “SEALANT SCHEDULE” at end of this specification section for locations of Sealant Types.

B. VOC Content: Sealants and sealant primers shall comply with the following:
1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.

C. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Modified Polyurethane (Type 1 Sealant):
1. Two or three-part conforming to ASTM C 920, Type M, Grade NS, Class 25.
2. Color: Custom colors as selected by Architect.
3. Acceptable products:
MasterSeal NP2, BASF the Chemical
Company Dymeric 240FC, Tremco.

E. Pourable Urethane (Type 2 Sealant):
1. Multicomponent conforming to ASTM C 920, Type M, Grade P (pourable), Class 25, Use T (traffic).
2. Color: Custom color as selected by Architect.
3. Acceptable products:
Urexpan NR-200, Pecora Corp.
MasterSeal SL 2 Sealant; BASF the Chemical
Company THC 900 (Self leveling) or 901 (low sag),
Tremco.

F. Pourable Urethane Sealant (Type 3 Sealant):
1. Single-component conforming to ASTM C 920, Type S, Grade P (pourable), Class 25, Use T (traffic).
2. Color: Gray or limestone as selected by Architect.
3. Acceptable products:
Sikaflex - 1CSL; Sika Corporation, Inc.
MasterSeal SL 1; BASF the Chemical
Company Vulkem 45; Tremco

G. Silicone, General Purpose (Type 4 Sealant)
   1. One-part rubber based silicone conforming to ASTM C 920, Type S, Grade NS, Class 100/50.
   2. Color: As selected by Architect.
   3. Acceptable products
      790 Building Sealant, Dow Corning. SCS2700 Silpruf LM, GE Silicones. Spectrem 1, Tremco.

H. Polyurethane Hybrid, Paintable (Type 5 Sealant):
   1. One-part, moisture-cure, polyurethane hybrid sealant for interior use, conforming to ASTM C 920, Type S, Grade NS, Class 35 and Fed. Spec TT-S-00230C, Class A, Type II.
   2. Acceptable product:
      Dymonic FC, Tremco

I. Silicone, Sanitary (Type 6 Sealant):
   1. One-part conforming to ASTM C 920, Type S, Grade NS, Class 25, F.D.A. Regulation 21 CFR177.2600, and FDA Food Additive Regulation 121.2514.
   2. Color: Clear.
   3. Acceptable products:
      786 Silicone Sealant - M, Dow Corning.
      SCS1700 Sanitary, GE Silicones.

J. Acrylic Latex (Type 7 Sealant)
   1. One-part, non-sag acrylic latex, siliconized, conforming to ASTM C 834, Type P, Grade NF.
   2. Acceptable products:
      AC-20+, Pecora Corp.
      Sonolac; BASF the Chemical Company
      Tremflex 834; Tremco.

K. Acoustical Sealant (Type 8 Sealant):
   1. Butyl rubber for concealed locations.
   2. Acceptable products:
      AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.
      Acoustical Sealant, Tremco
      Sheetrock Acoustical Sealant; USG Co.

L. Sealant (Type 9 Sealant):
   1. Joint Sealant: Air infiltration per ASTM E283, Water Penetration per ASTM E331.
   2. Provide one of the following sealant types approved
      product/manufacturer: Silicone: SilPruf LM SCS2700 as manufactured by GE Advanced Materials Siliconized Acrylic Latex: AC-20+ as manufactured by Pecora Corp. Urethane: Dymonic as manufactured by Tremco Incorporated.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D 1056 and D 1565 round. In vertical joints use closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width. In horizontal joints, use solid neoprene or butyl rubber, Shore A hardness of 70.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing substrate.

3.2 PREPARATION

A. Joint surfaces shall be clean and dry. Remove loose mortar and other material completely with compressed air or by brushing.
   1. Joints to be caulked shall be at least ¼" wide unless specifically specified smaller. At any point where the width of the joint is appreciably less, cut or grind out the joint to that width to assure an adequate volume of sealant along the length of the joint, except at concrete paving joints, those shall remain ⅛" wide as indicated.
   2. Pack with backing material the voids and recesses around metal frames which are deeper than the depth required for caulking. Leave the proper depth for the sealant.
   3. In open joints and where detailed, install rod stock as backing material. Roll the material into the joints to avoid stretching. The natural thickness of the rod stock shall be approximately twice the thickness of the joint in which it is installed.
   4. In raked masonry joints, apply a bondbreaker strip of polyethylene or masking tape along the bottom of the joints.
   5. Where sealant is to be applied against smooth metal surfaces, wipe these surfaces clean with a suitable ketone solvent immediately prior to caulking.
   6. Particular attention shall be paid to the preparation of horizontal joints in wear surfaces to be filled with sealant. Adjust joint depth to comply with sealant manufacturer's recommendations by malleting down the joint filler or filling in with rod stock as may be required. Joints in concrete paving shall be primed in accordance with manufacturer’s recommendations.
   7. Perform preparation in accordance with ASTM C 1193 for solvent release sealants, C 1193 for latex base sealants, C 919 for acoustical applications, and C 1193 for elastomeric sealants.

3.3 APPLICATION

A. Priming: Prime porous joint surfaces, particularly masonry and concrete. Test the primer to make sure it causes no staining of the material on which it is applied.

B. Depth of sealant: Seal joints to a depth of approximately ½ the joint width, but never less than ¼" deep. Follow the sealant manufacturer's recommendations where possible.

C. Apply the sealant in accordance with the manufacturer's instructions.
   1. Force the sealant into joints with enough pressure to expel all air and provide a solid filling. Correct any flowing or sagging before final inspection is made.
   2. Where adjacent surfaces permit, use masking tape to obtain straight, even lines. Remove tape immediately after the joints have been sealed.
   3. Fill joints flush with adjacent surfaces except where a recessed joint is specifically detailed. Tool beads with a sled runner or similar tool to insure full contact with joint faces.
   4. For caulking horizontal joints in wear surfaces, use a gun with a narrow nozzle. Apply the flow type sealant with the nozzle riding along the bottom so that the sealant is forced up to completely fill the slot without cavities. Provide and use a portable vacuum cleaner to remove loose dirt from the joints just ahead of the caulking gun.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Tool joints concave. Sealant shall achieve a firm skin before surface coating is applied.

3.4 CLEANING/REPAIRING

A. Clean adjacent surfaces of soiling due to caulking operations. This applicator shall be responsible for and shall bear the cost of replacing any material damaged or discolored due to caulking operations.

B. Repair or replace defaced or disfigured finishes caused by work of this section.

3.5 SEALANT SCHEDULE

A. Locations specified below for sealants and caulking required under this section are general and shall not be considered as affecting the required use of sealing compounds specified under other sections of the specifications.

SEALANT TYPE		APPLICATION
1	a.	Interior vertical joints at perimeter of window, door, and storefront elements where adjacent to stone, masonry, or concrete surfaces.
2	a.	Interior horizontal control and expansion joints in flooring, stone, masonry and tile flooring and at junctures between these materials and other adjacent materials.
3	a.	Exterior horizontal control and expansion joints in concrete
	b.	paving. Filling of roof penetration pockets (pitch pans)**.**
4	a.	Sealing of joints between plumbing fixtures and substrates and between plastic laminate splashes and adjacent tops and walls.
	b.	Threshold and windowsills set in full bed of sealant.
	c.	Exterior vertical joints at perimeter of window, door, and storefront elements where adjacent to concrete surfaces.
	d.	Reglets: The top groove along the surface-mounted flashing reglets.
	e.	Sealing joints in sheet metal fabrications.
5	a.	General caulking as part of interior painting in joints subject to movement.
6	a.	Sealing joints between countertops and substrates in concession areas and elsewhere which may be in contact with food.
7	a.	General caulking as part of interior painting.
8	a.	Setting sill track, head track, and end studs to substrates on acoustically rated partitions. Refer to SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES for application requirements.
9	a.	Sealing of joints in exterior glass-mat gypsum sheathing

3.6 **FIELD QUALITY CONTROL**

A. **Quality Assurance Inspections: Sealant joint materials, accessories, and installation are sub-ject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.**

B. **Testing Agency: Installing subcontractor may perform these tests with observation by General Contractor and Building Envelope Commissioning Agent.**

C. **Field Adhesion Testing: Test completed and cured sealant joints as follows: Extend of testing: Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and**

joint substrate. Conduct field tests for each kind of sealant and joint substrate indicated.

D. **Test Method: Test joint sealants according to Method A, Field-applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.**

E. **Report whether sealant failed to adhere to joint substrates or tore cohesively. For sealants that failed adhesively, retest until satisfactory adhesion is obtained.**

F. **Record test results in a field-adhesion-test log.**

G. **Repair sealants pulled from test area by applying new sealants following the same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.**

END OF SECTION

SECTION 07 95 13

EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Expansion joint assemblies for floor, wall and ceiling surfaces.

B. Related Sections:
1. Section 03 11 00 - Concrete Forming and Accessories: Expansion and contraction joints in exterior concrete joints.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof control joints.
3. Section 07 92 00 - Joint Sealants: Expansion and control joints.
4. **Section 01 91 19 - Building Envelope Commissioning**
5. **Section 07 05 23 - Pressure Testing the Air Barrier System for Air Tightness**

1.2 SUBMITTALS

A. General: Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Provide joint assembly profiles, dimensions, locations in the Work, affected adjacent construction, anchorage devices, available colors and finish, and locations of splices. Provide Manufacturer's Installation Instructions. Indicate rough-in sizes.

C. Certificates: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.

D. Samples: Submit two 4" long samples, illustrating profile, dimension, color, and finish selected.

E. Templates: For cast-in or placed frames or anchors, and indicate tolerances for item placement.

F. LEED Submittals:
1. Product data and certification letter indicating percentages by weight of post-consumer and pre- consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

1.3 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

1.4 EXTRA MATERIALS

A. Furnish under provisions of SECTION 01 78 40 - SPARE PARTS, OVERAGES, AND MAINTENANCE MATERIALS.

B. Provide 25% overage of resilient joint filler, and special tools required for servicing components**.**

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design Products: The design for each architectural joint system is based on products by Construction Specialties, Inc. Subject to compliance with requirements, provide either the named products or comparable products by one of the following:
   Architectural Art Mfg. Inc.
   Balco Metalines, Div. of Balco,
   Inc. MM Systems Corp.

B. Substitutions: In accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

2.2 MATERIALS

A. Extruded Aluminum: ANSI/ASTM B 221 6063-T5 alloy for extrusions; ASTM B 308 Alloy 6061-T6, for sheet and plate.

B. Resilient Filler: Extruded vinyl exhibiting Shore 'A' hardness of 40 - 65 Durometer**.**

C. Threaded Fasteners: Stainless steel.

D. Primer: Manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials, or provide bituminous paint, impregnated paper or felt, or an alkali-resistant insulating coating.

E. Fire Rated Systems: Fire barrier caulk (SECTION 07 84 00 - FIRESTOPPING), fire blanket, and insulation.

2.3 FABRICATION

A. All Metal Joint Covers: Aluminum frame construction, free of gaskets and fillers, designed to permit plus or minus 50% joint movement with full recovery, recess mounted**.**

B. Joint Covers: Flexible dual durometer extruded preformed gasket bonded to extruded aluminum retainers for interior expansion joints in floors and walls.
   1. Covers shall be single or multilayered rubber extrusions as classified under ASTM D 2000, with continuous, longitudinal, internal baffles and formed to fit compatible frames. Expansion joint seals shall be as manufactured by Construction Specialties, Inc., or approved equivalent. See drawings for types.
   2. Extruded preformed gasket color(s) shall be as selected by Architect**.**

C. Concealed aluminum surfaces in direct contact with masonry and concrete shall be shop coated with Manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials, or provide bituminous paint, impregnated paper or felt, or an alkali-resistant insulating coating..

D. Galvanize embedded ferrous metal anchors and fastening devices.

E. Shop assemble components and package with anchors and fittings.

F. Provide joint components in single length wherever practical. Minimize site splicing.

2.4 FINISHES

A. Floors: Mill finish.

B. Walls and Ceilings: Clear anodized.

C. Resilient Filler Exposed to View: Color as selected by Architect from standard colors**.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive the materials of this section.

B. Verify that joint preparation and affected dimensions are acceptable.

3.2 PREPARATION

A. Provide anchoring devices for installation.

B. Provide templates and rough-in measurements.

3.3 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor components to substrate to prevent misalignment.

D. Install fire-rated systems where required.

3.4 PROTECTION OF FINISHED WORK

A. Protect finished work under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

B. Do not permit traffic over unprotected floor joint surfaces.

C. Provide removable coating to protect finish surface.

3.5 **FIELD QUALITY CONTROL**

A. **Quality Assurance Inspections: Expansion joint materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.**

END OF SECTION

SECTION 08 11 00

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hollow metal doors and frames, sidelight frames, and borrowed light frames.

B. Related Sections:
1. Section 08 14 23 - Plastic-laminate-faced Wood Doors.
2. Section 08 71 00 - Door Hardware: hardware locations.
3. Section 08 80 00 - Glazing: glass for doors, sidelights, and borrowed lights.
4. Section 09 91 00 - Painting: finishing of hollow metal doors and frames.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
1. Include door sizes, construction, frame types, wall anchors, and accessories required for installation.

B. LEED Submittals:
1. Environmental Product Declaration: For each product.
2. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable local building codes for fire rated requirements of metal door/metal frame and wood door/metal frame assemblies.

B. Fire Rated Door Construction: Conform to NFPA 252 or UL 10C.

1.4 QUALITY ASSURANCE

A. Standard: Provide steel doors and frames complying with the Steel Door Institute SDI-100 and as herein specified. Hollow metal provider that is not a member of the Steel Door Institute is not approved and must submit product data and samples for review.

B. Fire-Rated Door Assemblies: Provide door and frame assemblies which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252 and which are labeled and listed for ratings indicated by UL. Metal UL classification markers shall be attached to these doors and frames.
1. Test Pressure (positive-pressure testing): After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.

C. Conform to requirements of SDI-100.

D. Installed frame and door assembly to conform to UL 10C for fire-rated class indicated or scheduled.

E. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal doors and frames to the project site with no dents or open seams and store upright in a protected dry area. Provide packaging and wrapping to protect hollow metal items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide steel doors and frames as manufactured by one of the following: Ceco Door Products; an ASSA ABLOY Group Co.
Curries Company; an ASSA ABLOY Group Co.
Deansteel Mfg., Inc.
Mesker Door, Inc.
Republic Builders Products Co.
Steelcraft; an Ingersoll-Rand Co.

2.2 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Sheet and Strip: ASTM A 1008, commercial quality, leveled, cold-rolled steel free of scale and other surface defects.

2.3 FABRICATION

A. Flush Steel Doors: Full flush type of welded seamless construction with no visible seams or joints on faces or vertical edges.
1. Face sheets of 18 gage steel reinforced, stiffened and sound-deadened by laminating to small cell impregnated kraft honeycomb core completely filling the door or by formed steel vertical stiffeners spaced 6" o.c. and attached to face sheets by spot welds and with the spaces between stiffeners filled with inorganic blanket insulation material. At exterior doors, provide insulation value of R - 8.0 for foamed-in-place polyurethane. At fire rated doors, provide mineral fiberboard core as scheduled and/or as required to meet applicable codes.
2. Continuous vertical interlocking joints on lock and hinge edges with seams continuously welded, filled and dressed smooth. Bevel vertical edges.
3. Top and bottom edges closed with continuous recessed steel channels spot welded to both faces. Top edge of exterior doors sealed flush with closing channel to exclude water.
4. Fixed glass moldings welded to security side of door. Loose moldings of 20 gage steel fastened with countersunk flat head screws. Fabricate stops to receive vinyl gaskets.
5. Overlapping steel astragals for pairs of labeled doors as required by manufacturer to meet codes.
6. Louvers: Provide factory installed, inverted "V" or "Y" sightproof type fixed louvers. Louver blades shall be 18 gage and frame shall be 18 gage welded construction.

B. Steel Frames: Combination buck, frame and trim type of 16 gage steel for interior frames and 14 gage steel for exterior frames. Provide frames with face width, throat opening, backbend, and jamb depth as per dimensions shown.
1. Brake-form to profile free of warp, buckles, and fractures with corners square and sharp. Form stop integral with frame except where detailed otherwise. Dress sheared edges straight and smooth.
2. Close corner joints tight with trim faces mitered and continuously welded. Dress exposed welds flush and smooth.
3. Fabricate frames for large openings in knocked-down sections for field assembly with butt joints and internal reinforcing sleeves. Knocked-down frame assemblies shall be trial assembled in the shop.
4. Loose glazing stops shall be 16 gage steel, mitered corners, fastened with countersunk flathead screws. Fabricate stops to receive vinyl gaskets.
5. Weld 14 gage steel floor anchors inside each jamb with two holes each anchor for floor anchor

bolts.

6. Furnish frames with steel spreader temporarily fastened to the feet of both jambs for rigidity during shipping and handling.
7. For each jamb in masonry construction provide 3 or more 16 gage adjustable jamb anchors of the T- strap type spaced not more than 30" apart. Furnish yoke type Underwriters anchors for labeled door openings only.
8. For each jamb in steel stud construction provide 4 or more 18 gage drywall type jamb anchors. Weld anchors inside each jamb and wire or bolt to the studs.

C. Shop Finish: After fabrication, doors and frames shall be degreased, phosphatized, and factory painted inside and out with a rust inhibitive synthetic primer. Apply mineral filler to eliminate weld scars and other blemishes.

D. Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.

E. Reinforce frames wider than 48" with roll formed steel channels fitted tightly into frame head, flush with top.

F. Prepare frame for silencers. Provide three single rubber silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.

G. Attach fire-rated label to each frame and door unit.

H. Close top edge of exterior door flush with inverted steel channel closure. Seal joints watertight.

I. Fabricate frames for masonry wall coursing with 2" head member.

2.4 HARDWARE PREPARATION

A. Prepare doors and door frames for hardware. Mortising, reinforcing, drilling, and tapping shall be done at the factory for mortised hardware. Reinforcement shall be provided for surface-applied hardware, and the drilling and tapping for this hardware shall be done in the field. Provide plaster guards for hinge and strike reinforcements and cutouts on frames.

B. Reinforcement plates in doors and frames for hardware shall be 7 gage for hinges and 12 gage for all other hardware.

C. Punch for and install rubber silencers on all interior hollow metal door frames. Furnish 3 silencers for each single door and 2 silencers for each pair of doors. Set out and adjust strikes to provide clearance for the silencers. Omit silencers on exterior door frames.

2.5 CLEARANCES

A. Doors shall have pre-fit clearances of:
   1. At Head and Lock Stile: 1/8".
   2. At Hinge Stile: 1/16".
   3. At Door Sill:
      a. Without Threshold: 1/8" from bottom of door to top of decorative floor finish or covering.
      b. With Threshold: 1/8" from bottom of door to top of threshold.
   4. Between meeting edges of pair of doors: 1/8".

B. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80. Bevel fire-rated doors 1/8" in 2" in lock edge.

2.6 ACCESSORIES

A. Rubber Silencers: Resilient rubber.

B. Anchors: Three per jamb, typically, of type to suit supportive construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

3.2 INSTALLATION

A. Install frames in accordance with SDI-105.

B. Install doors in accordance with DHI.

C. Install fire-rated frames and place fire-rated doors in accordance with NFPA 80.

D. Coordinate with masonry and wallboard construction for anchor placement.

E. Coordinate installation of glass and glazing.

F. Install doors accurately in frames, maintaining specified clearances.

G. Setting Frames:
1. Check frames for rack, twist and out-of-square, and correct.
2. Set frames accurately to maintain scheduled dimensions, hold head level and maintain jambs plumb and square.
3. Anchor frames securely to adjacent construction. Anchor to floor at each jamb with two bolts to prevent twist.
4. Leave spreader bars in place until frames have been permanently built into the walls.
5. Install fire-rated frames in accordance with NFPA 80.

H. Hanging Doors:
1. Fit and hang the doors to maintain specified door clearances. Metal hinge shims are acceptable to maintain clearances.
2. Doors shall be out of wind and shall operate smoothly and quietly after adjustment.
3. Place fire-rated doors with clearances as specified in NFPA 80.

3.3 TOLERANCES

A. Maximum Diagonal Distortion: 1/8" measured with straight edge, corner to corner.

END OF SECTION

SECTION 08 14 23

PLASTIC-LAMINATE-FACED WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Solid core plastic-faced wood doors.

B. Related Sections:
1. Section 06 40 00 - Architectural Woodwork: laminate clad cabinets.
2. Section 08 11 00 - Hollow Metal Doors and Frames: hollow metal frames.
3. Section 08 71 00 - Door Hardware: location of hardware.
4. Section 08 80 00 - Glazing: glass for doors.
5. Section 12 32 16 - Manufactured Plastic-laminate-clad Casework

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Indicate sizes, construction, core materials, edge banding dimensions and stop profile.

C. Product Data: Indicate door core materials and construction; type and characteristics.

D. Samples:
1. Submit a sample, 6" by 6", of each plastic laminate finish and color selected.
2. Submit a 12" x 12" sample of solid core door panel indicating construction, core, face and edge detail.
3. Submit 8-1/2" x 11" paint color samples of door glazing frame paint.

E. Certificates: Submit certification that doors comply with reference standards fabrication requirements, signed by authorized representative of door manufacturer.

F. LEED Submittals:
1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
6. Product data for adhesives and composite wood products, indicating that product contains no urea formaldehyde.

1.3 QUALITY ASSURANCE

A. Standard: Comply with the requirements of "Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program" as published by Architectural Woodwork Institute.

B. Manufacturer:
1. Company specializing in manufacturing the products specified in this section with minimum

three years documented experience.

2. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC- accredited certification body.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.4 DELIVERY

A. Deliver doors to the project site ready for installation and to receive hardware. Each unit shall be individually plastic wrapped at the factory for protection in transit and storage.

1.5 WARRANTY

A. Special Warranty: Provide Life-of-Installation warranty on manufacturer's standard form, signed by manufacturer, installer, and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84- inch section. Warranty shall specifically include installation of replacement doors required during term of the warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide plastic laminate faced wood doors as manufactured by one of the following: Eggers Industries, Architectural Door Div.
Marshfield DoorSystems,
Inc. VT Industries, Inc.

2.2 MATERIALS AND FABRICATION

A. LEED:
1. Regional Materials: Wood doors shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
2. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
4. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.

B. Flush Doors: Premium Grade, PC-HPDL-3 (3-ply), as defined in Section 1300 of AWI Quality Standards.
1. Core: Particleboard meeting Type I, Density C, Class 1 of CS 236.
2. Stiles: Vertical edges at least 1-1/8" and bonded to core. Species shall be close grain hardwood with factory-painted finish to match faces.
3. Rails: Top and bottom rail edges at least 1-1/8" and bonded to core. Mill option.
4. Faces: HGS (nominal 0.048") high pressure decorative laminated plastic conforming to NEMA LD 3. Laminate to be bonded to both faces. Fire-rated plastic laminate faced wood doors shall be surfaced with fire-rated (UL Stamped) laminated plastic sheet. Color shall be as selected by Architect from manufacturer's full color and pattern range. Product/manufacturer; one of the following:
Formica Brand Laminate; Formica Corp.
Nevamar; TexMar, Inc.
Pionite Decorative Laminate; Pioneer Plastics Corp.

Wilsonart; Ralph Wilson Plastics Co.

5. Stops: Provide shop primed metal glazing frames at all light openings. Fasten by through-bolted countersunk flathead screws. Field painted color as selected by Architect.

C. Fitting:
1. Cutouts for mortise hardware shall be made to template at the factory.
2. Top and bottom rail edges and core exposed by cutouts for hardware shall be factory sealed.
3. Doors shall have pre-fit clearances of:
   a. At Head and Lock Stile: 1/8"
   b. At Hinge Stile: 1/16"
   c. At Door Sill:
      1) Without Threshold: 1/8" from bottom of door to top of decorative floor finish or covering.
      2) With Threshold: 1/8" from bottom of door to top of threshold.
   d. Between meeting edges of pair of doors: 1/8"

2.3 ADHESIVE

A. Facing Adhesive: Type I - waterproof.

2.4 FABRICATION

A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.

B. Provide lock blocks at lock edge and top of door for closer for hardware reinforcement.

C. Fit door metal edge trim to edge of stiles after applying veneer facing.

D. Bond edge banding to cores.

E. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through-bolted hardware.

F. Factory pre-fit doors for frame opening dimensions identified on shop drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify frame opening conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 PREPARATION

A. Condition plastic faced wood doors to the average prevailing humidity in the building prior to fitting and hanging.

3.3 INSTALLATION

A. General: Installation of doors shall comply with the applicable requirements of Section 1700 Installation of Architectural Woodwork (Interior) of the AWI Quality Standards.

B. Hang doors to maintain uniform clearances. Doors shall be out of wind and shall operate

smoothly and quietly after adjustment. Replace doors damaged during installation.

C. Cutting and fitting of plastic laminate faced doors at the project site will not be permitted. Doors which do not fit properly shall be replaced.

D. Pilot drill screw and bolt holes.

E. Machine cut for hardware. Core for handsets and cylinders.

F. Coordinate installation of doors with installation of frames specified in SECTION 08 11 00 - HOLLOW METAL DOORS AND FRAMES and hardware specified in SECTION 08 71 00 - DOOR HARDWARE.

G. Coordinate installation of glass and glazing.

3.4 INSTALLATION TOLERANCES

A. Conform to AWI requirements for fit and clearance tolerances.

B. Maximum Diagonal Distortion (Warp): 1/8" measured with straight edge or taut string, corner to corner, over an imaginary 36" x 84" surface area.

C. Maximum Vertical Distortion (Bow): 1/8" measured with straight edge or taut string, top to bottom, over an imaginary 36" x 84" surface area.

D. Maximum Width Distortion (Cup): 1/8" measured with straight edge or taut string, edge to edge, over an imaginary 36" x 84" surface area.

3.5 ADJUSTING

A. Adjust work under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 08 31 00
ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wall and ceiling access doors.

B. Related Sections
1. Section 03 30 00 - Cast-In-Place Concrete: Openings in concrete.
2. Section 04 20 00 - Masonry Units: Openings in masonry.
3. Section 09 21 16 - Gypsum Board Assemblies: Openings in gypsum board walls and ceilings.
4. Section 09 30 13 - Ceramic Tiling.
5. Section 09 91 00 - Painting: Field paint finish.
6. Division 22 - Plumbing components requiring access.
7. Division 23 - Mechanical components requiring access.
8. Division 26 - Electrical components requiring access.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with UL requirements for fire-rated doors.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire-rated access units.

1.5 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

1.6 COORDINATION

A. Coordinate work under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Coordinate the work with mechanical and electrical work requiring access units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide wall and ceiling access doors as manufactured by one of the following:
J.L. Industries, Inc.
Karp Associates, Inc.
Larsen’s Mfg. Co.
Milcor Limited Partnership
Nystrom Building Products Co.

2.2 GENERAL

A. Flush metal panel access doors.

B. Size: As required for ease of access, but not less than 12" x 12".

C. Material:
1. Model M3202: Painted steel 14 gauge frame and door.
2. Model MS3202: Stainless steel 16 gauge frame and door.
3. Models DW3203 and K3200: Painted steel 16 gauge frame; 14 gauge door.
4. Model ATR3204: Painted steel 16 gauge frame; 18 gauge door.
5. Fire-Rated Model 3218: Painted and stainless steel 14 gauge frame; 20 gauge door.

D. Lock: Screwdriver operated, with metal cam.

2.3 ACCESS UNITS – WALLS (Basis of Design)

A. Non-Fire-Rated Door and Frame Unit:
1. In Cast-in-Place Concrete: Model M3202 (painted) manufactured by Milcor.
2. In Masonry: Model M3202 (painted) manufactured by Milcor.
3. In Ceramic Tile on Gypsum Board on Steel Studs: Model MS3202 (stainless steel) manufactured by Milcor.
4. In Gypsum Board on Steel Studs: Model DW3203 (painted) manufactured by Milcor.
5. In Plaster on Metal Furring: Model K3200 (painted) manufactured by Milcor.

B. Fire-Rated Door and Frame Unit: 1-1/2 hour UL B label fire rating
1. In Cast-in-Place Concrete: Model 3218 (painted) manufactured by Milcor.
2. In Masonry: Model 3218 (painted) manufactured by Milcor.
3. In Ceramic Tile on Gypsum Board on Steel Studs: Model 3218 (stainless steel) manufactured by Milcor.
4. In Gypsum Board on Steel Studs: Model 3218 (painted) manufactured by Milcor.
5. In Plaster on Metal Furring: Model 3218 manufactured by Milcor.

2.4 ACCESS UNITS – CEILINGS (Basis of Design)

A. Non-Fire-Rated Door and Frame Unit:
1. In Gypsum Board on Metal Furring: Model DW 3203 manufactured by Milcor.
2. In Plaster on Metal Furring: Model K3200 manufactured by Milcor.
3. In Metal T-Bar Ceiling: Model ATR 3204 manufactured by Milcor.

B. Fire-Rated Door and Frame Unit: 1-1/2 hour UL B label fire rating
1. In Gypsum Board on Metal Furring: Model 3218 manufactured by Milcor.
2. In Plaster on Metal Furring: Model 3218 manufactured by Milcor.

2.5 FINISHES

A. Painted Finish: One coat baked enamel primer with baked enamel finish, color as selected by Architect.

B. Stainless Steel: No. 4 finish.

C. Aluminum: Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that rough openings for door and frame are correctly sized and located.

3.2 INSTALLATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that rough openings for door and frame are correctly sized and located.

END OF SECTION

SECTION 083310 ROLLING FIRE DOORS FIREKING® MODEL 630

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rolling fire service doors.

1.2 RELATED SECTIONS

A. Section 05500 - Metal Fabrications: Support framing and framed opening.

B. Section 06200 - Finish Carpentry: Wood jamb and head trim.

C. Section 08710 - Door Hardware: Product Requirements for cylinder core and keys.

D. Section 09900 - Painting: Field applied finish.

E. Section 16130 - Raceway and Boxes: Conduit from electric circuit to door operator.

F. Section 16150 - Wiring Connections: Power to disconnect.

1.3 REFERENCES

A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NEMA MG 1 - Motors and Generators.

F. NFPA-80 – Standard for Fire Doors and Fire Windows.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Fire Rated Assemblies: Provide assemblies complying with NFPA 80 and listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.

B.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Details of construction and fabrication.
   4. Installation methods.

C. Shop Drawings: Include detailed plans and elevations, details of framing members, anchoring methods, clearances, hardware, and accessories.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience.

B. Installer Qualifications: Installer Qualifications: Company approved by manufacturer, specializing in performing Work of this section with minimum three years experience, with IDEA Certified Installers and service technicians on staff.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s two year limited warranty.

B. Warranty: Manufacturer's limited door and operators System warranty of all parts and components of the system except counterbalance spring and finish for 3 years or 20,000 cycles, whichever comes first.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Overhead Door Corporation, 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E- mail: info@overheaddoor.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 ROLLING FIRE SERVICE DOORS

A. Rolling Fire Service Doors: FireKing Model 630 Fire Doors.
1. Label: Provide fire doors certified with the following listing.

a. Rolling fire doors up to 152 sf (14.12 sm) and not exceeding 13 feet 6 inches (4.11 m) in width or height shall receive the UL or ULC 3-Hour Class A Label for installation on masonry or steel jamb walls, face mounted or between jambs. Door may be welded to the face of steel jambs.
b. Rolling fire doors up to 144 sf (13.7 sm) and not exceeding 12 feet (3.7 m) in height or width shall receive the FM 3-Hour Class A Label for installation on masonry or concrete walls or steel jamb walls, face mounted or between jambs.
c. Rolling fire doors up to 130 sf (12.1 sm) and not exceeding 11 feet (3.4 m) in height or 12 ft (3.7m) in width shall receive the FM 3-Hour Class A Label for installation on masonry or non-masonry fire walls with steel tubes set against fire walls.
d. Rolling fire doors up to 152 sf (14.12 sm) and 13 feet 6 inches (4.11 m) in width or height shall receive the UL or ULC 1-1/2-Hour Class B Label for installation on non-masonry walls, face mounted or between jambs.
e. Rolling fire doors up to 117 sf (13.4 sm) and not exceeding 11 feet (3.4 m) in height or width shall receive the FM 1-1/2-Hour Class B Label when installed on 2-hour fire-rated gypsum dry walls.

f. Rolling fire doors over 152 sf (14.12 sm) shall receive the UL Oversize Fire Door Label with masonry or steel wall construction. Face of wall mount: 41'2" max width, 25'4" max height, max area of 683 sf. Between jambs mount: 24'0" max width, 24'0" max height, 576 sf max area.
g. Rolling fire doors over 144 sf (13.4 sm) and not exceeding 18 ft (5.49 m) in height or width shall receive the FM Oversize Fire Door Label with masonry or steel construction. Doors over 18 ft (5.49 m) must be reviewed and certified by FM.

h. Provide UL labeled smoke protection where indicated. Comply with UL

label for "Leakage Rated Assembly" or "S" label.

1) Comply with NFPA 105 air leakage requirements.
2) Pass UL test procedure 1784.

2. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

a. Curved profile type C-187 for doors thru 14 feet (4.27 m) wide by 12 feet (3.65 m) high, fabricated of

1) 22 gauge galvanized steel.

b. Curved profile type C-187 for doors over 14 feet (4.27 m) thru 20 feet (6.10 m) wide, fabricated of:

1) 20 gauge galvanized steel.

c. Curved profile type C-275 for doors thru 14 feet (4.27 m) wide by 12 feet (3.65 m) high, fabricated of

1) 22 gauge galvanized steel.

d. Curved profile type C-275 for doors over 14 feet (4.27 m) thru 20 feet (6.10 m) wide, fabricated of:

1) 20 gauge galvanized steel.

e. Curved profile type C-275 for doors over 20 feet (6.10 m) thru 24 feet (7.31 m) wide, fabricated of:

1) 18 gauge galvanized steel.

f. Flat profile type F-265 for doors thru 14 feet (4.27 m) wide by 12 feet (3.65 m) high, fabricated of:

1) 22 gauge galvanized steel.

g. Flat profile type F-265 for doors over 14 feet (4.27 m) thru 20 feet (6.10 m) wide, fabricated of:

1) 20 gauge galvanized steel.

h. Flat profile type F-265 for doors over 20 feet (6.10 m) thru 24 feet (7.31 m) wide, fabricated of:

1) 18 gauge galvanized steel.

a. Galvanized Steel: Slats and hood galvanized steel to ASTM A 653 finished with a rust-inhibitive roll coating process, including bonderizing, a 0.2 mils thick baked prime paint, and a 0.6 mils thick baked top coat.

1) Polyester Top Coat.
   (a) Gray polyester.
   (b) Tan polyester.
   (c) White polyester.
   (d) Brown polyester.

b. Non-galvanized exposed ferrous surfaces shall be black powder coated.

5. Bottom Bar:
   a. Two black powder coated structural steel angles 1-1/2 inch by 1-1/2 inch by 1/8 inch (38 mm by 38 mm by 3 mm) minimum.

6. Guides: Three structural steel ang

   a. Fastening Guides to Masonry Fire Walls: UL listed for fire in accordance with manufacturer's listing.
   b. Fastening Guides to Masonry Fire Walls: UL listed for fire and smoke in accordance with manufacturer's listing.
   c. Fastening Guides to Non-Masonry Fire Walls: Comply with the manufacturer's listing.
7. Brackets:
   a. Hot rolled steel to support counterbalance, curtain and hood
8. Finish; Bottom Bar, Guides, and Brackets:

   a. Finish: Black powdercoat finish.

9. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
10. Hood:

   a. Fabricate of 24 gauge galvanized primed steel minimum for wall openings thru 19 feet (5.79 m) wide.

b. Fabricate of 22 gauge galvanized primed steel for wall openings over 19 feet (5.79 m) wide.
c. Hood equipped with thermally controlled, internal, galvanized steel flame baffle as required for FM listing.

d. Provide one intermediate support bracket for wall openings over 13 feet 6 inches (4.11 m) wide
e. Provide two support brackets for wall openings over 19 feet (5.79 m) wide.

11. Manual Operation:

a. Manual push.
b. Crank operation.
c. Floor resettable chain hoist.

12. Electric Motor Operation: Provide electric operator as listed in the door UL file, for size as recommended by manufacturer to move door in either direction.
a. Floor Resettable Electric Motor Operation.
b. Sensing Edge Protection:

1) Electric sensing edge.

c. Operator Controls:

1) Push-button operated control stations with open, close, and stop buttons.

13. Automatic Closure Standard Fire Door: UL approved release mechanism equipped with a 165 degree fusible link.
a. Doors will be equipped with chain hoist release mechanism, requiring only one sash chain to be routed to the operated side (sash chain not required to be routed to adjusting wheel side.)
1) Release mechanism includes planetary gear differential system.
2) Door will close by a thermally actuated link rated @165 degrees F, or by an optional listed releasing device, or by manually activating the release handle.
3) All counterbalance spring tension shall be maintained when the release mechanism is activated.
4) After closing by manual activation of the release handle, the door shall be able to be reset by one person from one side of the door (re-engaging the release handle). No tools are required to reset the release mechanism.
b. Doors will be equipped with floor resettable electric motor operation system, requiring only one sash chain to be routed to the operated side (sash chain not required to be routed to adjusting wheel side.)
1) Release mechanism includes planetary gear differential system.
2) Door will close by a thermally actuated link rated @165 degrees F, or by an optional listed releasing device, or by manually activating the release handle.
3) All counterbalance spring tension shall be maintained when the

release mechanism is activated.

4) After closing by alarm activation with power on the electric motor, the door shall be able to be reset by resetting the alarm system without additional tools required.

c. Fire Sentinel time-delay release mechanism provides an added measure of safety to control the doors' closure.

14. Governor: If required by the size for chain hoist doors, provide a viscous governor to regulate the rate of descent of door in a quiet manner. Use an engagement type that is not engaged during normal door operation, but after cable release, will retard the speed during automatic door closure to under 24 inches per second and not less than 6 inches per second per NFPA 80.

15. Locking:

a. Two interior bottom bar slide bolts for manually operated doors.

16. Wall Mounting Condition:

Face of wall.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install rolling counter fire doors in compliance with requirements of NFPA 80. Test fire-release system and reset components after testing.

C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

F. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.

G. Install and test Fire Sentinel release device(s) in accordance with the manufacturer's instructions and in compliance with applicable regulations and codes of the local authority having jurisdiction.

H. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

I. Install perimeter trim and closures.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Release device(s) shall be tested and witnessed for proper operation with the door manufacturer recommendations

C. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 FIELD QUALITY CONTROL

A. Functional testing of fire door and window assemblies shall be performed by IDEA Certified personnel with knowledge and understanding of the operating components of the type of door being subject to testing.

3.6 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.7 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 08330 ROLLING SERVICE DOORS STORMTITE™ MODEL 625

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulated rolling service doors.

1.2 RELATED SECTIONS

A. Section 05500 - Metal Fabrications: Support framing and framed opening.

B. Section 06200 - Finish Carpentry: Wood jamb and head trim.

C. Section 08333 - Security Grilles.

D. Section 08710 - Door Hardware: Product Requirements for cylinder core and keys.

E. Section 09900 - Painting: Field applied finish.

F. Section 16130 - Raceway and Boxes: Conduit from electric circuit to door operator and from door operator to control station.

G. Section 16150 - Wiring Connections: Power to disconnect.

1.3 REFERENCES

A. ANSI/DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.

B. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.

C. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.

D. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

E. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

G. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

H. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

J. NEMA MG 1 - Motors and Generators.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

B. Warranty: Manufacturer’s limited door system warranty for 2 years for all parts and components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Overhead Door Corporation, 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 INSULATED ROLLING SERVICE DOORS

A. Stormtite Insulated Rolling Service Doors: Overhead Door Corporation Model 625.
   1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
      a. Flat profile type F-265i for doors up to 40 feet (12.19 m) wide.
      b. Front slat fabricated of:
         1) 24 gauge galvanized steel.

         1) 24 gauge galvanized steel.

      d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
         1) R-Value: 7.7, U-Value: 0.13.
         2) Sound Rating: STC-21.
   2. Performance:
      a. Through Curtain Sound Rating: Sound Rating: STC-28 (STC-30+ with HZ noise generator) as per ASTM E 90.
      b. Installed System Sound Rating: STC-21 as per ASTM E 90.
      c. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
      d. Air Infiltration: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft2.
   3. Slats and Hood Finish:

a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.

1) Polyester Top Coat.
(a) Gray polyester.
(b) Tan polyester.
(c) White polyester.
(d) Brown polyester.

3) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.

4. Weatherseals:
a. Vinyl bottom seal, exterior guide and internal hood seals.

b. Interior guide weatherseal.
c. Lintel weatherseal.
d. Air Infiltration Package, IECC 2012/2015 listed; product to meet C402.4.3 2012 Air leakage <1.00 cfm/ft2.

1) Air infiltration perimeter seal package includes: guide cover, guide cap, dual brush exterior guide seal, 4 inch finned lintel brush seal and vinyl bottom seal.

5. Bottom Bar:

a. Two prime painted steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.

6. Guides: Three structural steel angles.
7. Brackets:

a. Hot rolled prime painted steel to support counterbalance, curtain and hood.

8. Finish; Bottom Bar, Guides, Headplate and Brackets:

a. PowderGuard Premium powder coat in black color.
b.

9. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
10. Hood: Provide with internal hood baffle weatherseal.

a. 24 gauge galvanized steel with intermediate supports as required.

12. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less

than 2/3 foot nor more than 1 foot per second.

a. Sensing Edge Protection:

1) Electric sensing edge.

b. Operator Controls:

1) Push-button operated control stations with open, close, and stop buttons

7) Controls surface mount.

d. Motor Voltage: 115/230 single phase, 60 Hz.

13. Wind Load Design:

a. Standard wind load shall be 20 PSF.

b.

14. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

16. Wall Mounting Condition:

a. Face-of-wall mounting.

17. Insulated Vision Lites: Provide with uniformly spaced o

a. Size: 10 inch by 1 inch (254 mm by 25.4 mm)

b. Provide with dual wall polycarbonate lites.

PART 3 EXECUTION

1.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

1.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

1.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

G. Install perimeter trim and closures.

H. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

1.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

1.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

1.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 084113

ALUMINUM-FRAMED ENTRANCES

AND STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section covers Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

B. Types of Kawneer Aluminum Storefront Systems include:
   1. Trifab® 451UT Framing System:
      a. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension
      b. Thermal
      c. Center Plane
      d. Screw Spline Fabrication

C. Related Sections:
   1. 072700: Air Barriers
   2. 079200: Joint Sealants
   3. 083213: Sliding Aluminum-Framed Glass Doors
   4. 084113: Aluminum-Framed Entrances and Storefronts
   5. 084413: Glazed Aluminum Curtain Walls
   6. 085113: Aluminum Windows
   7. 088000: Glazing
   8. 107113: Exterior Sun Control Devices
   9. 122600: Interior Daylighting Devices

1.3 DEFINITIONS

A. For fenestration industry standard terminology and definitions, refer to the Fenestration & Glazing Industry Alliance (FGIA) Glossary (AAMA AG-13).

1.4 PERFORMANCE REQUIREMENTS

A. General Performance:
   1. Product to comply with the specified performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction, as determined by testing of aluminum storefront systems representing those indicated for this project.

2. Aluminum storefront systems shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
3. Failure includes any of these events:
   a. Thermal stresses transferring to building structure
   b. Glass breakage
   c. Loosening or weakening of fasteners, attachments, and other components
   d. Failure of operating units

B. Delegated Design:
1. Design aluminum storefront systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind Loads:
1. See structural drawings.

D. Air Leakage:
1. The test specimen shall be tested in accordance with ASTM E 283.
2. With interior seal, air leakage rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.2 psf (300 Pa).
3. Without interior seal, air leakage rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 1.6 psf (75 Pa).
4. CSA A440 Fixed Rating

E. Water Resistance:
1. The test specimen shall be tested in accordance with ASTM E 331.
2. There shall be no leakage at a minimum static air pressure differential of 10 psf (479 Pa) as defined in AAMA 501.

F. Uniform Load Structural:
1. A static air design load of 30 psf (1436 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330.
2. There shall be no deflection in excess of L/175 of the span of any framing member.
3. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

G. Seismic:
1. When tested to AAMA 501.4, system must meet design displacement (elastic) of 0.010 times the story height and ultimate displacement (inelastic) of 1.5 times the design displacement.

H. Thermal Movements:
1. Allow for thermal movements resulting from the following:
   a. 0°F (-18 C) to 180°F (82 C) maximum change (range) in ambient and surface temperatures
   b. 75°F (24 C) test interior ambient air temperature

2. Test performance shows no buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5 for a minimum 3 cycles.

I. Thermal Transmittance (U-factor):
1. Thermal transmittance test results are based upon 1" (25.4 mm) clear high-performance insulating glass [1/4" (e=0.035, #2), 1/2" warm edge spacer and argon fill gas, 1/4"].
2. When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: .32 (HP glass) or project specific (____) Btu/hr/ft^2/°F per AAMA 507 or (____) Btu/hr/ft^2/°F per NFRC 100.
3. Condensation Resistance Factor (CRF) or Condensation Index (CI):
4. If using CRF: When tested to AAMA Specification 1503, the CRF shall not be less than 68_{frame} and 68_{glass} (low-e).
5. If using CI: When tested to CSA A-440, the CI shall not be less than 60_{frame} and 62_{glass} (low-e).

J. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC):
1. Sound transmission loss test results in accordance with AAMA 1801 are based upon 1" (25.4 mm) clear double laminated insulating glass with PVB interlayer (1/8", 0.030", 1/8", 1/2" AS, 1/8", 0.030", 1/8").
2. Ratings shall not be less than STC 37 and OITC 30.

K. Environmental Product Declaration (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule.

L. Material Ingredient Reporting:
1. Shall have a complete list of chemical ingredients to at least 100 ppm (0.01%) that covers 100% of the product.
2. Acceptable documentation includes:
   a. Manufacturer's inventory with Chemical Abstract Service Registration Number (CASRN or CAS#):
      1) Kawneer's Material Transparency Summary (MTS)
   b. Cradle to Cradle certification; either document listed below is acceptable for this option:
      1) Cradle to Cradle Certified™ with Material Health section Silver or higher
      2) Silver Level or higher Material Health Certificate
   C. Red List Free DECLARE label

1.5 SUBMITTALS

A. Product Data:
1. For each type of aluminum-framed storefront system indicated, include:
   a. Construction details
   b. Material descriptions
   c. Dimensions of individual components and profiles
   d. Hardware
   e. Finishes
   f. Installation instructions

2. Recycled Content:
    a. Provide documentation that aluminum has a minimum of 50% mixed pre- and post-consumer recycled content.
    b. Provide a sample document illustrating project-specific information that will be provided after product shipment.
    c. After product has shipped, provide project-specific recycled content information:
        1) Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.
        2) Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.
        3) Indicate the location for recovery of recycled content.
        4) Indicate the location of the manufacturing facility.
3. Environmental Product Declaration (EPD):
    a. Include a Type III Product-Specific EPD created from a Product Category Rule.
4. Material Ingredient Reporting:
    a. Include documentation for material reporting that has a complete list of chemical ingredients to at least 100 ppm (0.01%) that covers 100% of the product.

B. Shop Drawings:
1. Plans
2. Elevations
3. Sections
4. Details
5. Hardware
6. Attachments to other work
7. Operational clearances
8. Installation details

C. Samples for Initial Selection:
1. Provide samples for units with factory-applied color finishes.
2. Provide samples of hardware and accessories involving color selection.

D. Samples for Verification:
1. Provide a verification sample for aluminum-framed storefront system and required components.

E. Product Test Reports:
1. Provide test reports for each type of aluminum-framed storefront used in the project.
2. Test reports must be based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency.
3. Test reports must indicate compliance with performance requirements.

F. Fabrication Sample:
1. Provide a fabrication sample of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:

a. Joinery, including concealed welds
b. Anchorage
c. Expansion provisions
d. Glazing
e. Flashing and drainage

G. Entrance Door Hardware Schedule:
1. Schedule shall be prepared by or under the supervision of supplier.
2. Schedule shall detail fabrication and assembly of entrance door hardware, including procedures and diagrams.
3. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer must have successfully installed the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications:
1. Manufacturer must be capable of providing aluminum-framed storefront systems that meet or exceed performance the stated performance requirements.
2. Manufacturer must document this performance by the inclusion of test reports and calculations.

C. Source Limitations:
1. Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options:
1. Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Product Requirements Section. Do not modify size and dimensional requirements.
2. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups:
1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
2. Build mockups for the type(s) of storefront elevation(s) indicated, in location(s) shown on drawings.

F. Pre-installation Conference:
1. Conduct conference at project site to comply with requirements in Division 01 Project Management and Coordination Section.

G. Structural-Sealant Glazing must comply with ASTM C 1401, “Guide for Structural Sealant Glazing” for design and installation of structural-sealant-glazed systems.

H. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 PROJECT CONDITIONS

A. Field Measurements:
1. Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication.
2. Indicate measurements on shop drawings.

1.8 WARRANTY

A. Submit manufacturer's standard warranty for owner's acceptance.

B. Warranty Period:
1. Two years from Date of Substantial Completion of the project provided however that in no event shall the Limited Warranty begin later than six months from date of shipment by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product:
1. Kawneer Company, Inc.
2. Trifab® 451UT Framing System:
a. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension
b. Thermal
c. Center Plane
d. Screw Spline Fabrication

B. Substitutions:
1. Refer to Division 01 Substitutions Section for procedures and submission requirements.
2. Pre-Contract (Bidding Period) Substitutions:
a. Submit written requests ten (10) days prior to bid date.
3. Post-Contract (Construction Period) Substitutions:
a. Submit written request in order to avoid installation and construction delays.
4. Product Literature and Drawings:
a. Submit product literature and drawings modified to suit specific project requirements and job conditions.
5. Certificates:
a. Submit certificate(s) certifying that the substitute manufacturer (1) attests to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacture, and fabrication of aluminum storefronts for a period of not less than ten (10) years. (*Company Name*)
6. Test Reports:
a. Submit test reports verifying compliance with each test requirement required by the project.

7. Samples:
    a. Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

C. Substitution Acceptance:
1. Acceptance will be in written form, either as an addendum or modification.
2. Acceptance will be documented by a formal change order signed by the owner and contractor.

2.2 MATERIALS

A. Aluminum Extrusions:
1. Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish.
2. Not less than 0.070" (1.8 mm) wall thickness at any location for the main frame
3. Complying with ASTM B221: 6063-T6 alloy and temper
4. Recycled Content:
    a. Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
    b. Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.
    c. Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.
    d. Indicate the location for recovery of recycled content.
    e. Indicate the location of the manufacturing facility.

B. Fasteners:
1. Nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories:
1. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.

D. Reinforcing Members:

E. Sealant:
1. For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances:
1. References to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

G. Red List Free:
1. All parts and materials comply with the Living Building Challenge/DECLARE Red List and the Cradle-to-Cradle (C2C) Banned List:
    a. PVC-free
    b. Neoprene-free

2. Product does not contain PVC or Neoprene.

2.3 STOREFRONT FRAMING SYSTEM

A. Thermal Barrier:
1. Kawneer DUAL Isolock® Thermal Break with two (2) 1/4" (6.4 mm) separations consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
2. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Brackets and Reinforcements:
1. Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.

C. Fasteners and Accessories:
1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials.
2. Where exposed, fasteners and accessories shall be stainless steel.

D. Perimeter Anchors:
1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

E. Packing, Shipping, Handling, and Unloading:
1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection:
1. Store materials so that they are protected from exposure to harmful weather conditions.
2. Handle material and components to avoid damage.
3. Protect material against damage from elements, construction activities, and other hazards before, during, and after installation.

2.4 GLAZING SYSTEMS

A. Glazing to meet requirements in Division 08 Glazing Section.

B. Glazing Gaskets:
1. Manufacturer's standard compression types
2. Replaceable, extruded EPDM rubber

C. Spacers and Setting Blocks:
1. Manufacturer's standard elastomeric type

D. Bond-Breaker Tape:
1. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing sealants as recommended by manufacturer for joint type, and as follows:
   1. Weatherseal sealant:
      a. ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O
      b. Single-component neutral-curing formulation that is compatible with the structural sealant and other system components with which it comes in contact
      c. Recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use
      d. Color: Matching structural sealant

2.5 ENTRANCE DOOR SYSTEMS

A. Refer to Entrance Doors as specified in Division 084113 Aluminum-Framed Entrances and Storefronts Section.

B. Refer to Entrance Door Hardware as specified in Division 084113 Door Hardware Section.

2.6 ACCESSORY MATERIALS

A. Versoleil® SunShade:
   1. Anchors shall be painted:
      a. Select from Kawneer’s standard paints and colors. Custom colors are available upon request.
   2. Louvers and fascia shall be painted or anodized:
      a. Painted: Select from Kawneer’s standard paints and colors. Custom colors are available upon request.
      b. Anodized: Select from Kawneer's anodized finishes.

B. InLighten® Light Shelf:
   1. Aluminum light shelf system that consists of anchor channels, support beams, fascia trims, and Aluminum Composite Material (ACM) panels.
   2. Anchored directly to the curtain wall intermediate horizontal members.
   3. Interior-mounted to reflect daylight deeper into interior space.
   4. Light Shelf system consists of:
      a. Aluminum Composite Material (ACM) panel, 4 mm thick.
      b. Translucent polycarbonate panel, 4 mm or 16 mm thick.
      c. ACM finish on upper and lower surface selected from Kawneer standard finishes.
      d. Extruded aluminum outriggers and fascia.
      e. Extruded aluminum anchor designed to secure to compatible verticals of framing system.
      f. Anchor shall be designed to engage shelf so as to allow the shelf to rotate down and safely hang on its own for cleaning.
      g. Extruded aluminum shear blocks designed to hinge on the anchors to allow rotating individual shelves for cleaning.
      h. Panel/shelf projection not exceeding 30" (762 mm).
      i. Mullion spacing of framing system shall not exceed 6’ (1.83 m) on center.
      j. Panel/shelf deflection shall not exceed 1/120 of horizontal span length.
   5. Framing system to support Light Shelf (select one from list):

a. Curtain wall framing system
b. Storefront framing system

6. Submittals for Light Shelf:
   a. Manufacturer's installation instructions
   b. Samples for verification:
      1) Factory-applied finish as selected by architect
      2) Functioning Light Shelf sample demonstrating operation
   c. Shop drawing, including plans, elevations, sections, fabrication, and installation details
   d. Validation from manufacturer of single-source for light shelf and framing system and compatibility between the systems

C. Joint Sealants:
   1. For installation at perimeter of aluminum-framed systems, as specified in Division 07 Joint Sealants Section.

D. Bituminous Paint:
   1. Cold-applied asphalt-mastic paint
   2. Complies with SSPC-Paint 12 requirements except containing no asbestos
   3. Formulated for 30-mil (0.762 mm) thickness per coat

2.7 FABRICATION

A. Fabricate framing member components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations
   2. Accurately fitted joints that are flush, hairline, and weatherproof
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior
   4. Physical and thermal isolation of glazing from framing members
   5. Accommodations for thermal and mechanical movements of glazing and framing that maintain required glazing edge clearances
   6. Provisions for field replacement of glazing
   7. Fasteners, anchors, and connection devices that are concealed from view to the greatest extent possible

B. Mechanically Glazed Framing Members:
   1. Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members:
   1. Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing:
   1. Fabricate components for assembly using manufacturer’s standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in project according to shop drawings.

2.8 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color Clear Anodized)

PART 3 EXECUTION

3.1 EXAMINATION

A. With installer present, examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work:
   1. Verify rough opening dimensions.
   2. Verify levelness of sill plate.
   3. Verify operational clearances.
   4. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components for proper water management.
   5. Masonry Surfaces:
      a. Masonry surfaces must be visibly dry and free of excess mortar, sand, and other construction debris.
   6. Wood Frame Walls:
      a. Wood frame walls must be dry, clean, sound, well nailed, free of voids, and without offsets at joints.
      b. Ensure that nail heads are driven flush with surfaces in opening and within 3" (76.2 mm) of opening.
   7. Metal Surfaces:
      a. Metal surfaces must be dry and clean (free of grease, oil, dirt, rust, corrosion, and welding slag).
      b. Ensure that metal surfaces are without sharp edges or offsets at joints.

B. Proceed with installation only after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system so that components:
   1. Are level, plumb, square, and true to line
   2. Are without distortion and do not impede thermal movement
   3. Are anchored securely in place to structural support
   4. Are in proper relation to wall flashing and other adjacent construction

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather-tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
   1. Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.
   2. Conduct tests for air infiltration and water penetration with manufacturer’s representative present.
   3. Tests that do not meet the specified performance requirements and units that have deficiencies shall be corrected as part of the contract amount.
   4. Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
   5. Air Infiltration Tests:
      a. Conduct tests in accordance with ASTM E 783.
      b. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.
   6. Water Infiltration Tests:
      a. Conduct tests in accordance with ASTM E 1105.
      b. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.2 psf (300 Pa).

B. Manufacturer's Field Services:
   1. Upon owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjusting: Not applicable.

B. Protection:
   1. Protect installed product’s finish surfaces from damage during construction.

C. Cleaning:
   1. Clean glass immediately after installation.
      a. Comply with glass manufacturer's written recommendations for final cleaning and maintenance.
      b. Remove non-permanent labels and clean surfaces.
   2. Clean aluminum surfaces.
   3. Avoid damaging protective coatings and finishes.
   4. Remove excess sealants, glazing materials, dirt, and other substances.
   5. Repair or replace damaged installed products.

6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.
7. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 084113

NOTES AND DISCLAIMERS

Laws and building and safety codes governing the design and use of Kawneer products, such as glazed entrance, window, and curtain wall products, vary widely. Kawneer does not control the selection of product configurations, operating hardware, or glazing materials, and assumes no responsibility therefor. It is the responsibility of the owner, the specifier, the architect, the general contractor, and the installer and the fabricator/transformer, consistent with their roles, to determine the appropriate materials for a project in strict conformity to all applicable national, regional and local building codes and regulations.

Kawneer reserves the right to change configuration without prior notice when deemed necessary for product improvement.

Information contained herein or related hereto is intended only for evaluation by technically skilled persons, with any use thereof to be at their independent discretion and risk. Such information is believed to be reliable, but Kawneer shall have no responsibility or liability for results obtained or damages resulting from such use.

This guide specification is intended to be used by a qualified construction specifier. The guide specification is not intended to be used verbatim as a project specification without appropriate modifications for the specific use intended. The guide specification must be used and coordinated with the procedures of each design firm and the particular requirements of a specific construction project.

Kawneer grants no license under, and shall have no responsibility or liability for infringement of, any patent or other proprietary right. Nothing in this document should be construed as a warranty or guarantee by Kawneer, and the only applicable warranties will be those set forth in Kawneer acknowledgment or in any printed warranty documents issued by Kawneer. The foregoing may be waived or modified only in writing by a Kawneer officer.

© 2010, Kawneer Company, Inc.

SECTION 084413

GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section covers Kawneer Architectural Aluminum Curtain Wall Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.

B. Types of Kawneer Aluminum Curtain Wall Systems include:
   1. 1600UT System™1 Curtain Wall with 1" (25.4 mm) double glazed insulating glass:
      a. Sight line: 2-1/2" (63.5 mm)
      b. Outside glazed pressure plate format
      c. System depth: 6" (152.4 mm) or 7-1/2" (190.5 mm)

C. Related Sections:
   1. 072700: Air Barriers
   2. 079200: Joint Sealants
   3. 084113: Aluminum-Framed Entrances and Storefronts
   4. 088000: Glazing
   5. 107113: Exterior Sun Control Devices
   6. 122413: Interior Daylighting Devices

1.3 DEFINITIONS

A. For fenestration industry standard terminology and definitions, refer to the Fenestration & Glazing Industry Alliance (FGIA) Glossary (AAMA AG-13).

1.4 PERFORMANCE REQUIREMENTS

A. General Performance:
   1. Product to comply with the specified performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction, as determined by testing of glazed aluminum curtain walls representing those indicated for this project.
   2. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   3. Failure includes any of these events:
      a. Thermal stresses transferring to building structure
      b. Glass breakage
      c. Loosening or weakening of fasteners, attachments, and other components

d. Failure of operating units

B. Delegated Design:
1. Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind Loads:
1. See structural drawings

D. Air Leakage:
1. Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/ft^2 (0.31 l/s·m^2) of fixed wall area as determined according to ASTM E 283 and TAS 202 at a minimum static-air-pressure differential of 6.2 psf (300 Pa).

E. Water Resistance:
1. Static:
a. The test specimen shall be tested in accordance with TAS 202 and ASTM E 331.
b. There shall be no leakage at a minimum static air pressure differential of 15 psf (720 Pa) as defined in AAMA 501.
2. Dynamic:
a. The test specimen shall be tested in accordance with AAMA 501.1.
b. There shall be no leakage at an air pressure differential of 15 psf (720 Pa) as defined in AAMA 501.

F. Structural-Test Performance:
1. Test according to ASTM E 330 and TAS 202.
2. When tested at positive and negative wind load design pressures, assemblies do not evidence deflection exceeding L/175 of clear span.
3. A static air design load of 40 psf (1915 Pa) shall be applied in the positive and negative direction.
a. When tested at 150% of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2% percent of clear span.
b. Minimum test duration according to ASTM E 330 is 10 seconds.

G. Structural-Test Performance:
1. Based on Aluminum Association “Specification for Aluminum Structures” or CSA CAN3-S157 “Strength Design in Aluminum”.
2. There shall be no deflection exceeding L/175 of the span of any framing member at design load.

H. Deflection of Framing Members at Design Wind Pressure:
1. Deflection Normal to Wall Plane:
a. Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite, or an amount that restricts edge deflection of individual glazing lites to 3/4" (19 mm), whichever is less.

b. Limit deflection of clear span of framing members to L/175 for spans less than or equal to 13'-6" (4.11 meters) and L/240 + 1/4" for spans greater than 13'-6" (4.11 meters).

2. Deflection Parallel to Glazing Plane:
   a. Operable Units - Provide a minimum 1/16-inch (1.6 mm) clearance between framing members and operable units.
   b. Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller
   c. Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm)
3. Cantilever Deflection:
   a. Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.

I. Thermal Movements:
1. Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   a. Temperature Change (Range): 0 °F (-18 °C); 180 °F (82 °C).
   b. Test Interior Ambient Air Temperature: 75 °F (24 °C).
   c. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performancewhen tested according to AAMA 501.5 for a minimum 3 cycles.

J. Seismic:
1. When tested to AAMA 501.4, system must meet design displacement (elastic) of 0.010 times the story height and ultimate displacement (inelastic) of 1.5 times the design displacement.
2. When tested to AAMA 501.6, system must meet dynamic seismic drift causing glass fallout (ΔFallout) of 4.9" or 0.0300 times the story height.

K. Thermal Transmittance (U-factor), Physical Test:
1. Thermal transmittance test results in accordance with AAMA 1503 are based upon argon-filled 1" (25.4 mm) or 1-3/4" (44.4 mm) clear low-emissivity coated glass with warm edge spacer.
2. For 1" (25.4 mm) low-emissivity coated glass: When tested using AAMA 1503, the thermal transmittance (U-factor) shall not be more than 0.33 Btu/(hr·ft^{2}·°F).
3. For 1-3/4" (44.4 mm) low-emissivity coated glass: When tested using AAMA 1503, the thermal transmittance (U-factor) shall not be more than 0.24 Btu/(hr·ft^{2}·°F).

L. Thermal Transmittance (U-factor), Simulation:
1. Thermal transmittance simulation results using NFRC 100 or AAMA 507 are based upon argon-filled 1" (25.4 mm) or 1-3/4" (44.4 mm) clear low-emissivity coated glass with warm edge spacer.
2. For 1" (25.4 mm) glass with Center of Glass (COG) U-factor of 0.24 Btu/(hr·ft^{2}·°F) and warm edge spacer, when simulated using NFRC 100 or AAMA 507, the thermal transmittance (U-factor) shall not be more than 0.32 Btu/(hr·ft^{2}·°F).
3. For 1-3/4" (44.4 mm) glass with Center of Glass (COG) U-factor of 0.12 Btu/(hr·ft^{2}·°F) and warm edge spacer, when simulated using NFRC 100 or AAMA 507, the thermal transmittance (U-factor) shall not be more than 0.22 Btu/(hr·ft^{2}·°F).

M. Condensation Resistance Factor (CRF):

1. Condensation resistance test results in accordance with AAMA 1503 or CSA A440 are based upon argon-filled 1" (25.4 mm) or 1-3/4" (44.4 mm) clear low-emissivity coated glass with warm edge spacer.
2. For 1" (25.4 mm) glass: When tested using AAMA 1503, the CRF_{frame} and CRF_{glass} shall not be less than 79 and 76 respectively.
3. For 1-3/4" (44.4 mm) glass: When tested using AAMA 1503, the CRF_{frame} and CRF_{glass} shall not be less than 82 and 81 respectively.

N. Temperature Index (I):
1. 1600UT System™1 Curtain Wall with aluminum pressure plate,
   a. For 1" (25.4 mm) double glazed low-emissivity coated glass: when tested to CSA-A440-00, the TI_{frame} and TI_{glass} shall not be less than 71 and 67 respectively.
   b. For 1-3/4" (44.4 mm) triple glazed low-emissivity coated glass: when tested to CSA-A440-00, the TI_{frame} and TI_{glass} shall not be less than 74 and 77 respectively.
2. 1600UT System™1 Curtain Wall with fiberglass pressure plate.
   a. For 1" (25.4 mm) double glazed low-emissivity coated glass: when tested to CSA-A440-00, theTI_{frame} and TI_{glass} shall not be less than 76 and 68 respectively.
   b. For 1-3/4" (44.4 mm) triple glazed low-emissivity coated glass: when tested to CSA-A440-00, theTI_{frame} and TI_{glass} shall not be less than 76 and 78 respectively.

O. Solar Heat Gain Coefficient:
1. Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than (____) as determined according to NFRC 200.

P. Sound Transmission Loss:
1. When tested to ASTM E90 and ASTM E1425, the Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) shall not be less than:
   a. STC 31 or OITC 25 based upon 1" (25.4 mm) insulating glass (1/4", 1/2" AS, 1/4")
   b. STC 33 or OITC 27 based upon 1-3/4" (44.4 mm) triple insulating glass (1/4", 1/2" AS, 1/4", 1/2" AS, 1/4")

Q. Storm Shelter Performance:
1. Shall be tested to meet ICC500: ICC / NSSA Standard for the design and construction of storm shelters.
2. Missile Criteria for tornado shelters.
   a. Design Wind Speed:
      1) 200 mph (EF4)
      2) 240 mph (EF5)
   b. Missile Speed:
      1) 90 mph (EF4)
      2) 100 mph (EF5)

R. Blast Mitigation Performance:

S. Environmental Product Declaration (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule.

T. Material Ingredient Reporting:
   1. Shall have a complete list of chemical ingredients to at least 100 ppm (0.01%) that covers 100% of the product.
   2. Acceptable documentation includes:
      a. Manufacturer's inventory with Chemical Abstract Service Registration Number (CASRN or CAS#):
         1) Kawneer's Material Transparency Summary (MTS)
      b. Cradle to Cradle certification; either document listed below is acceptable for this option:
         1) Cradle to Cradle Certified™ with Material Health section Silver or higher
         2) Silver Level or higher Material Health Certificate
      c. Red List Free DECLARE label

1.5 SUBMITTALS

A. Product Data:
   1. For each type of product indicated, include:
      a. Construction details
      b. Material descriptions
      c. Dimensions of individual components and profiles
      d. Finishes
   2. Recycled Content:
      a. Provide documentation that aluminum has a minimum of 50% mixed pre- and post-consumer recycled content.
      b. Provide a sample document illustrating project-specific information that will be provided after product shipment.
      c. After product has shipped, provide project-specific recycled content information:
         1) Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.
         2) Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.
         3) Indicate the location for recovery of recycled content.
         4) Indicate the location of the manufacturing facility.
   3. Environmental Product Declaration (EPD):
      a. Include a Type III Product-Specific EPD created from a Product Category Rule.
   4. Material Ingredient Reporting:
      a. Include documentation for material reporting that has a complete list of chemical ingredients to at least 100 ppm (0.01%) that covers 100% of the product.

B. Shop Drawings:
   1. Plans
   2. Elevations
   3. Sections
   4. Full-size details
   5. Attachments to other work

C. Samples for Initial Selection:
   1. Provide samples for units with factory-applied color finishes.

D. Samples for Verification:
   1. Provide a verification sample for each type of exposed finish required, in manufacturer's standard sizes.

E. Product Test Reports:
   1. Provide test reports for glazed aluminum curtain walls.
   2. Test reports must be based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency.
   3. Test reports must indicate compliance with performance requirements.

F. Fabrication Sample:
   1. Provide a fabrication sample of each vertical-to-horizontal intersection of aluminum-framed curtain wall systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
      a. Joinery
      b. Glazing

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer must have successfully installed the same or similar systemsrequired for the project and other projects of similar size and scope.

B. Manufacturer Qualifications:
   1. Manufacturer must be capable of fabricating glazed aluminum curtain walls that meet or exceed the stated performance requirements.

C. Source Limitations:
   1. Obtain aluminum curtain wall system through one source from a single manufacturer.

D. Product Options:
   1. Information on drawings and in specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   2. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups:
   1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   2. Build mockups for the type(s) of curtain wall elevation(s) indicated, in location(s) shown on drawings.

F. Pre-installation Conference:

1. Conduct conference at project site to comply with requirements in Division 01 Project Management and Coordination Section.

1.7 PROJECT CONDITIONS

A. Field Measurements:
1. Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication.
2. Indicate measurements on shop drawings.

1.8 WARRANTY

A. Submit manufacturer's standard warranty for owner's acceptance.

B. Warranty Period:
1. Two years from Date of Substantial Completion of the project provided however that in no event shall the Limited Warranty begin later than six months from date of shipment by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product:
1. Kawneer Company, Inc.
2. 1600UT System™1 Curtain Wall types:
a. 1600UT System™1 Curtain Wall with 1" (25.4 mm) double glazed insulating glass:
1) Sight line: 2-1/2" (63.5 mm)
2) Outside glazed pressure plate format
3) System depth: 7-1/2" (190.5 mm)
3. Test to AAMA 501-05 and TAS 202.

B. Substitutions:
1. Refer to Division 01 Substitutions Section for procedures and submission requirements.
2. Pre-Contract (Bidding Period) Substitutions:
a. Submit written requests ten (10) days prior to bid date.
3. Post-Contract (Construction Period) Substitutions:
a. Submit written request in order to avoid installation and construction delays.
4. Product Literature and Drawings:
a. Submit product literature and drawings modified to suit specific project requirements and job conditions.
5. Certificates:
a. Submit certificate(s) certifying that the substitute manufacturer (1) attests to adherence to specification requirements for curtain wall system performance criteria, and (2) has been engaged in the design, manufacture, and fabrication of aluminum curtain walls for a period of not less than ten (10) years. (*Company Name*).
6. Test Reports:

a. Submit test reports verifying compliance with each test requirement required by the project.

7. Samples:

a. Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

C. Substitution Acceptance:

1. Acceptance will be in written form, either as an addendum or modification.
2. Acceptance will be documented by a formal change order signed by the owner and contractor.

2.2 MATERIALS

A. Aluminum Extrusions:

1. Alloy and temper recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish
2. Not less than 0.070" (1.8 mm) wall thickness at any location for the main frame
3. Complying with ASTM B221: 6063-T6 alloy and temper
4. Recycled Content:

a. Shall have a minimum of 50% mixed pre- and post-consumer recycled content.

b. Indicate recycled content, including the percentage of pre- and post-consumer recycled content per unit of product.

c. Indicate the relative dollar value of recycled content product to the total dollar value of product included in the project.

d. Indicate the location for recovery of recycled content.

e. Indicate the location of the manufacturing facility.

B. Aluminum Sheet Alloy:

1. Shall meet the requirements of ASTM B209.

C. Fasteners:

1. Aluminum, nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

D. Anchors, Clips, and Accessories:

1. Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.
2. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.

E. Pressure Plate:

1. Pressure plate shall be aluminum or fiberglass.
2. Pressure plate shall be fastened to the mullion with stainless steel screws.
3. Fiberglass pressure plate shall be tested to ASTM D638, D790, D695, D953, D3846.

F. Reinforcing Members:

1. Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.
2. Reinforcing members must provide sufficient strength to withstand the design pressure indicated.

G. Sealant:
1. For sealants required within fabricated curtain wall system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

H. Thermal Barrier:
1. Thermal barrier consists of 1" (25.4 mm) separation between the interior and exterior metal members in a typical condition.
2. Thermal barrier assembly shall be tested to the thermal cycling requirements of ASTM E2692 and show no sign of degradation following the test.

I. Tolerances:
1. References to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

J. Red List Free:
1. All parts and materials comply with the Living Building Challenge/DECLARE Red List and the Cradle-to-Cradle (C2C) Banned List:
   a. PVC-free
   b. Neoprene-free
2. Product does not contain PVC or Neoprene.

2.3 CURTAIN WALL FRAMING

A. Framing Members:
1. Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads
2. Glazing System: Four-sided captured
3. Glazing Plane: Front

B. Glass:
1. 1" (25.4 mm) and 1-3/4" (44.4 mm) insulating glass option
2. 1/4" (6.4 mm) or 1" (25.4 mm) for spandrel applications

C. Brackets and Reinforcements:
1. Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.

D. Framing Sealants:
1. Shall be suitable for glazed aluminum curtain wall as recommended by sealant manufacturer.

E. Fasteners and Accessories:

1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials.
2. Where exposed, fasteners and accessories shall be stainless steel.

F. Perimeter Anchors:
1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

G. Packing, Shipping, Handling, and Unloading:
1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

H. Storage and Protection:
1. Store materials so that they are protected from exposure to harmful weather conditions.
2. Handle material and components to avoid damage.
3. Protect material against damage from elements, construction activities, and other hazards before, during, and after installation.

2.4 GLAZING

A. Glazing to meet requirements in Division 08 Glazing Section.

B. Available Glazing Options:
1. Outside glazed pressure plate format with 1" (25.4 mm) double glazed and 1-3/4" (44.4 mm) triple glazed insulating glass.

C. Glazing Gaskets:
1. Gaskets to meet requirements of ASTM C864.

D. Spacers and Setting Blocks:
1. Manufacturer's standard elastomeric type

E. Bond-Breaker Tape:
1. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

F. Glazing Sealants:
1. As recommended by manufacturer for joint type.

2.5 OPERABLE UNITS

A. Doors comply with Division 08 Aluminum-Framed Entrances and Storefronts Section.

B. Windows comply with Division 08 Aluminum Windows Section.

2.6 ACCESSORY MATERIALS

A. Bituminous Paint:
1. Cold-applied asphalt-mastic paint

2. Complies with SSPC-Paint 12 requirements except containing no asbestos
3. Formulated for 30-mil (0.762 mm) thickness per coat

B. Versoleil® SunShade - Outrigger/Single Blade System:
1. Aluminum sunshade that consists of outriggers, louvers, and fascia which may be selected from standard configurations, modified configurations, or customized configuration.
2. Anchored directly to the vertical curtain wall mullions.
3. Anchors shall be painted:
   a. Select from Kawneer's standard paints and colors. Custom colors are available upon request.
4. Louvers and fascia shall be painted or anodized:
   a. Painted: Select from Kawneer's standard paints and colors. Custom colors are available upon request.
   b. Anodized: Select from Kawneer's anodized finishes.

C. InLighten® Light Shelf:
1. Aluminum light shelf system that consists of anchor channels, support beams, fascia trims, and Aluminum Composite Material (ACM) panels.
2. Anchored directly to the curtain wall intermediate horizontal members.
3. Interior-mounted to reflect daylight deeper into interior space.
4. Light Shelf system consists of:
   a. Aluminum Composite Material (ACM) panel, 4 mm thick.
   b. Translucent polycarbonate panel, 4 mm or 16 mm thick.
   c. ACM finish on upper and lower surface selected from Kawneer standard finishes.
   d. Extruded aluminum outriggers and fascia.
   e. Extruded aluminum anchor designed to secure to compatible verticals of framing system.
   f. Anchor shall be designed to engage shelf so as to allow the shelf to rotate down and safely hang on its own for cleaning.
   g. Extruded aluminum shear blocks designed to hinge on the anchors to allow rotating individual shelves for cleaning.
   h. Panel/shelf projection not exceeding 30" (762 mm).
   i. Mullion spacing of framing system shall not exceed 6' (1.83 m) on center.
   j. Panel/shelf deflection shall not exceed 1/120 of horizontal span length.
5. Framing system to support Light Shelf (select one from list)
   a. Curtain wall framing system
   b. Storefront framing system
6. Submittals for Light Shelf:
   a. Manufacturer's installation instructions
   b. Samples for verification:
      1) Factory-applied finish as selected by architect
      2) Functioning Light Shelf sample demonstrating operation
   c. Shop drawing, including plans, elevations, sections, fabrication, and installation details
   d. Validation from manufacturer of single-source for light shelf and framing system and compatibility between the systems

2.7 FABRICATION

A. Extrude or form aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations
   2. Accurately fitted joints
   3. Physical and thermal isolation of glazing from framing members
   4. Accommodations for thermal and mechanical movements of glazing and framing that maintain required glazing edge clearances
   5. Provisions for field replacement of glazing from exterior
   6. Fasteners, anchors, and connection devices that are concealed from view to the greatest extent possible
   7. Internal weeping system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior
   8. Double seal design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

C. Curtain Wall Framing:
   1. Fabricate components for assembly using shear block system following manufacturer's standard installation instructions.

D. After fabrication, clearly mark components to identify their locations in project according to shop drawings.

2.8 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color Bronze)

PART 3 EXECUTION

3.1 EXAMINATION

A. With installer present, examine areas for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Proceed with installation only after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Curtain Wall System Installation:
   1. Install curtain wall systems plumb, level, and true to line, without warp or rack of frames, within manufacturer’s prescribed tolerances, and complying with installation instructions.

2. Provide support and anchor in place.
3. Dissimilar Materials:
   a. Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
4. Glazing:
   a. Glass shall be outside-glazed.
   b. Glass shall be held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners that are spaced no more than 9" (228.6 mm) on center.
5. Water Drainage
   a. Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations.
   b. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

B. Related Products Installation:
1. Sealants (Perimeter):
   a. Refer to Joint Treatment (Sealants) Section.
2. Glass:
   a. Refer to Glass and Glazing Section.
   b. Reference: ANSI Z97.1, CPSC 16 CFR 1201, and GANA Glazing Manual.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
1. Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter-caulked, and cured.
2. Conduct tests for air infiltration and water penetration with manufacturer’s representative present.
3. Tests that do not meet the specified performance requirements and units that have deficiencies shall be corrected as part of the contract amount.
4. Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
5. Air Infiltration Tests:
   a. Conduct tests in accordance with ASTM E 783.
   b. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.
6. Water Infiltration Tests:
   a. Conduct tests in accordance with ASTM E 1105.
   b. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf (383 Pa).

B. Manufacturer's Field Services:
1. Upon owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjusting: Not applicable.

B. Protection:
   1. Protect installed product's finish surfaces from damage during construction.
   2. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

C. Cleaning:
   1. Repair or replace damaged installed products.
   2. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.
   3. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.
   4. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 084413

NOTES AND DISCLAIMERS

Laws and building and safety codes governing the design and use of Kawneer products, such as glazed entrance, window, and curtain wall products, vary widely. Kawneer does not control the selection of product configurations, operating hardware, or glazing materials, and assumes no responsibility therefor. It is the responsibility of the owner, the specifier, the architect, the general contractor, and the installer and the fabricator/transformer, consistent with their roles, to determine the appropriate materials for a project in strict conformity to all applicable national, regional and local building codes and regulations.

Kawneer reserves the right to change configuration without prior notice when deemed necessary for product improvement.

Information contained herein or related hereto is intended only for evaluation by technically skilled persons, with any use thereof to be at their independent discretion and risk. Such information is believed to be reliable, but Kawneer shall have no responsibility or liability for results obtained or damages resulting from such use.

This guide specification is intended to be used by a qualified construction specifier. The guide specification is not intended to be used verbatim as a project specification without appropriate modifications for the specific use intended. The guide specification must be used and coordinated with the procedures of each design firm and the particular requirements of a specific construction project.

Kawneer grants no license under, and shall have no responsibility or liability for infringement of, any patent or other proprietary right. Nothing in this document should be construed as a warranty or guarantee by Kawneer, and the only applicable warranties will be those set forth in Kawneer acknowledgment or in any printed warranty documents issued by Kawneer. The foregoing may be waived or modified only in writing by a Kawneer officer.

© 2011, Kawneer Company, Inc.

SECTION 086250
TUBULAR DAYLIGHTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tubular daylighting devices (TDD) and accessories.

1.2 RELATED SECTIONS

A. Section 06100 (06 10 00) - Wood Framing. Site built wood curbs and nailers.

B. Section 07540 (07 54 00) - Thermoplastic Membrane Roofing. Flashing of skylight base.

C. Section 07600 (07 60 00) - Flashing and Sheet Metal. Metal curb flashings.

D. Section 15810 (23 30 00) - HVAC Air Distribution. Fan vent duct and connections.

E. Section 16570 (25 50 00) - Integrated Automation Facility Controls. Lighting controllers.

F. Section 16150 (26 05 00) - Common Work Results Electrical. Power cable, power supply and electrical connections.

G. Section 16500 (26 09 43) - Lighting Equipment and Controls. Control cable, dimming controls, light bulbs, and lamps.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA/WDMA/CSA 101/I.S.2/A440 - Standard/Specification for Windows, Doors, and Unit Skylights; 2011.

B. American National Standards Institute (ANSI):
   1. ANSI C63.4-2014 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

C. ASTM International (ASTM):
   1. ASTM A463/A463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process.
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process.
   3. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   5. ASTM D635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position.
   6. ASTM D1929 - Test Method for Ignition Properties of Plastics.
   7. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
   8. ASTM F1642 - Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.
   9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   10. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

11. ASTM E283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
12. ASTM E308 - Standard Practice for Computing the Colors of Objects by Using the CIE System.
13. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors.
14. ASTM E547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain walls by Cyclic Air Pressure Difference.
15. ASTM E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
16. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane.
17. ASTM F2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loading.

D. California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1).

E. CAN/ULC S102.2, S102.3. Standard Test Method of Test for Surface Burning Characteristics of Flooring, and Miscellaneous Materials and Assemblies.

F. Code of Federal Regulations (CFR):
1. CFR 47 - Code of Federal Regulations (CFR) Rules and Regulations for FCC, FCC Part 15 - Radio Frequency Devices, Subpart B - Unintentional Radiators, Section 15.107 - Conducted Limits, and 15.109 - Radiated Emission Limits

G. CSA Group (CSA):
1. CSA C22.2 No. 250.0 - Luminaires.

H. European Parliament Directive:
1. Restriction of Hazardous Substances (RoHS) - Directive 2011/65/EU Annex II including amendment (EU) 2015/863 (RoHS 3).

I. European Standards (EN):
1. EN 55015:2013+A1:2015 - Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment.
2. EN 60598-1:2015+A1:2018 - Luminaires. General requirements and tests.
3. EN 60598-2-2:2012 - Luminaires - Part 2-2: Particular requirements - Recessed luminaires.
4. EN 61000-3-2:2014 - Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase).
5. EN 61000-3-3:2013 - Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <=16 A per phase and not subject to conditional connection.
6. EN 61547:2009 - Equipment for general lighting purposes. EMC immunity requirements.

J. Factory Mutual (FM):
1. FM Standard 4431 - The Approval Standard for Skylights.

K. Federal Emergency Management Agency (FEMA):
1. FEMA P-361 - Safe Rooms for Tornadoes and Hurricanes.

L. General Services Administration (GSA):
1. GSA-TS01-2003: Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.

M. International Building Code (IBC):
   1. IBC Section 1710 - Load Test Procedure for Wind Load Testing on Rooftop Daylight Collecting System - Structural Performance Testing - Devised by ATI PE); 2012.
   2. IBC Section 2606.7.2 - Installation - Diffuser Fall Out Test (Devised by PE); 2012.

N. International Code Council (ICC):
   1. ICC 500 - Standard for the Design and Construction of Storm Shelters.

O. International Code Council Evaluation Service, Inc. (ICC-ES):
   1. ICC-ES AC-16 - Acceptance Criteria for Plastic Skylights; 2008.

P. Florida Building Code (TAS):
   1. TAS 201 - Impact Test Procedures.
   2. TAS 202 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading.
   3. TAS 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

Q. OSHA 29 CFR - 1910.23 (e)(8) (Guarding Requirements for Skylights); 1926 Subpart M (Fall Protection); 1926.501(b)(4)(i); 1926.501(i)(2); 1926.501(b)(4)(ii).

R. Unified Facilities Criteria (UFC):
   1. UFC 4-010-01, Change October 2013, DoD Minimum Antiterrorism Standards for Buildings.

S. Underwriters' Laboratories (UL):
   1. UL 2108 - Low Voltage Lighting Systems.
   2. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.4 PERFORMANCE REQUIREMENTS

A. Daylight Reflective Tubes: Spectralight Infinity with INFRAREDuction Technology combines ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance. Patented spectrally-selective optical surface yields an average total- and specular-reflectance for the Visible Light spectrum (400 nm to 700 nm) providing maximized visible light transmission and less than 25 percent reflectance for Infrared (IR) heat wavelengths (750 nm to 2500 nm) for minimized heat transmission, resulting in a spectrally-selective Total Solar Spectrum (250 nm to 2500 nm) reflectance less than 37 percent, as measured using a Perkin Elmer Lambda 1050 spectrophotometer with a Universal Reflectance Accessory. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance with ASTM E308.

B. SOLAMASTER 750 DS-O / 750 DS-C (OPEN/CLOSED CEILING)
   1. AAMA/WDMA/CSA 101/IS2/A440, Class CW-PG70, size tested 21 inch (530 mm) diameter, Type TDDOC and Type TDDCC.
      a. Air Infiltration Test:
         1) Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E283.
      b. Water Resistance Test:
         1) Passes water resistance; no uncontrolled water leakage with a pressure differential of 10.7 psf (512 Pa) or 15 percent of the design load (whichever is greater) and a water spray rate of 5 gallons/hour/sf for 24 minutes when tested in accordance with ASTM E547 and ASTM E331.
      c. Uniform Load Test: All units tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E330.
         1) No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive

permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 70 psf (3.35 kPa).

2. Hurricane Resistance:
   a. Meets Florida Building Code TAS, 201, TAS, 202 and TAS 203 for Impact and non-impact components for HVHZ and non-HVHZ applications.
   b. Meets ASTM E1886 and ASTM E1996 for missile and cyclic pressure differential testing for TDI Windstorm zones.
3. Fire Testing:
   a. Fire Rated Roof Assemblies:
      1) When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the International Building Code for Class A, B, and C roof assemblies.
      2) When used with Dome Edge Protection Band and Rooftop Fire Glazing, all domes meet prescriptive method of Option 1 of IBC 708A.2.1 and IWUIC 101.2
   b. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the International Building Code.
   c. Self-Ignition Temperature - Greater than 650 degrees F per ASTM D1929.
   d. Smoke Density: Rating no greater than 450 per ASTM E84 in way intended for use. Classification C.
   e. Rate of Burn and/or Extent: Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D635.
   f. Rate of Burn and/or Extent: Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D635.
4. ICC 500 / FEMA P-361 Compliance (Tested to comply with highest wind speed Safe Room design of 250 mph).
   a. Missile Impact: Passes: 15 pound, 13 foot 2 by 4 with a velocity of 98 fps when tested in accordance with ASTM E1886.
   b. Uniform Load Test: No failure when tested at a Positive Load of 325 psf and a Negative Load of 325 psf when tested in accordance with ASTM E330
   c. Design Pressure: No failure when tested at a Positive Pressure of 270 psf and a Negative Pressure of 270 psf when tested in accordance with ASTM E1886 (Air Pressure Cycling)
5. Fall Protection Performance:
   a. Passes fall protection test: No penetration of dome or curb cap when subject to 400 lb (160 Kg)/42 inch (1066 mm) impact drop test when tested in accordance with OSHA 29 CFR 1926.506(c) Safety Net Systems.
   b. Passes fall protection test: California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1) Skylight Screens.
6. Blast Resistance: ASTM F1642, ASTM F2912, GSA-TS01-2003, and UFC 4-010-01:
   a. Airblast Loading ASTM Hazard Rating: Passes: No Hazard Rating
   b. Airblast Loading UFC Level of Protection: Passes Medium Level of Protection
   c. Dynamic Overpressure Loading ASTM Hazard Rating: Passes: No Hazard Rating
   d. Dynamic Overpressure Loading UFC Level of Protection: Passes Medium Level of Protection

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Data sheets showing roof dome assembly, flashing base, reflective tubes, diffuser assembly, and accessories.

4. Installation requirements.

C. Shop Drawings. Submit shop drawings showing layout, profiles, and product components, including rough opening and framing dimensions, anchorage, roof flashings and accessories.

D. Electrical wiring diagrams and recommendations for power and control wiring.

E. Verification Samples: As requested by Architect.

F. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

G. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
1. List of Daylight Credits available for the products specified.
2. Data on Energy Optimization Performance Credits for the products specified.
3. Data on Perimeter and Non-Perimeter Controllability of Systems for use of Daylight Dimmer option with the products specified.
4. Data on potential Innovation in Design Credits which may be available for the innovative use of the products specified.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of twenty years experience in the top lighting industry. Secondary products shall be acceptable to the primary manufacturer.

B. Installer Qualifications: All products shall be installed by a single installer with a minimum of five years demonstrated experience, with adequate equipment, skilled workers, and practical experience to meet the project schedule.

C. Skylights shall conform with authorities having jurisdiction and be designed to meet design criteria of the project location and the following:
1. Skylights must be certified by NFRC.
2. Skylights must be Tested and labeled in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
3. Skylights must have Factory Mutual (FM) Approval Class Number 4431.
4. On projects which fall under the jurisdiction of the Florida Building Code, Skylights are required to have a current Florida Building Code (FBC) Number to meet the High Velocity Hurricane Zone (HVHZ) requirements and are required for acceptance of Work specified in this section. Skylight must comply with the jurisdictional code body's submittal data and supporting drawings and documentation. Where the code body's acceptance criteria differs from these specifications regarding components and hardware, the code body's requirements shall govern.
5. Meet or exceed OSHA 200 pound (90 kg) Drop Tests expressed in 29 CFR 1910.23(e)(8)
6. Skylights shall provide minimum 69 psf (3.30 kPa) design load.

D. Pre-Installation Meeting: Contractor shall convene a pre-installation meeting on the project site minimum one week before beginning work of this Section. The meeting shall include the Architect or Owner's Representative and representatives of all related trades to:
1. Coordinate between the at least the following trades.
   a. Roofing to install the flashing, skylight, and LED Light Kit (when specified). Cut holes in roof deck, and flash curb to deck,
   b. Ensure clear paths for TDD units and coordinate with mechanical so not to interfere with pathways.
   c. Electrical to wire components and program lighting controls.

2. Verify project requirements and site logistics.
3. Assess integrity of the roofing system and building structure.
4. Review manufacturer's installation instructions and warranty requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in a cool dry location protected from the weather and in the manufacturer's original unopened containers until ready for installation.

B. Store products in manufacturer's unopened packaging until ready for installation.

1.8 PROJECT CONDITIONS

A. Coordinate delivery schedule with the Contractor and project schedule to minimize on site storage.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

C. Store materials in a dry area, protected from freezing, staining, contamination or damage.

1.9 WARRANTY

A. Daylighting Device: Manufacturer's standard warranty for 10 years.

B. Electrical Parts: Manufacturer's standard warranty for 5 years, unless otherwise indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Solatube International, Inc., which is located at: Solatube International 2210 Oak Ridge Way; Vista, CA 92081-8341; Toll Free Tel: 888-765-2882; Tel: 760-597-4400 ; Fax: 760-597-4488; Email:request info (sales@solatube.com); Web:http://www.solatube.com

B. Substitutions: Submit for Approved Equal via Specification Section 012500 Substitution Procedures

C. Other Acceptable Manufacturers/Products:
1. Velux Tubular Daylighting Devices
2. Other Approved Equals will be reviewed

2.2 TUBULAR DAYLIGHTING DEVICES

A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

B. SolaMaster Series: Solatube Model 750 DS, 21 inch (530 mm) Daylighting System:
1. Model:
a. Solatube Model 750 DS-C Closed (Penetrating) Ceiling. AAMA Type TDDCC.
2. Capture Zone:
a. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
1) Outer Dome Glazing: Type DA, 0.125 inch (3.2 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100

percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.
a) Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
2) Acrylic Dome plus Inner Dome Glazing: Type DAI, Inner Dome is 0.115 inch (3 mm) minimum thickness acrylic classified as CC2 material.
b. Tube Ring: 0.090 inch (2.3 mm) nominal thickness injection molded ASA. Prevents thermal bridging between base flashing and tubing and channel condensed moisture. Attached to base of dome ring with butyl glazing rope 0.24 inch (6 mm) diameter; to minimize air infiltration.
c. Dome Seal: Adhesive backed weatherstrip, 0.63 inch (16 mm) tall by 0.28 inch (7 mm) wide.
3. Flashings:
a. Roof Flashing Base:
1) One Piece: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A653/A653M or ASTM A463/A463M or ASTM A792/A792M, 0.028 inch (0.7 mm) plus or minus .006 inch (.015 mm) thick.
a) Base Style: Type FC, Curb cap, with inside dimensions of 27 inches by 27 inches (685 mm by 685 mm) to cover curb as specified in Section 07600.
b. Curbs: Metal Insulated Roof Curb: Corrosion resistant 18 Gauge hot-dipped galvanized steel conforming to ASTM A653 G90 with continuous welded seams, integrated base plate for water tightness and extra strength, lined with 1-1/2 inch fiberglass fireproof sound attenuating thermal insulation, factory installed 2 by 2 treated wood nailer secured to top ledge of curb. Curb designed for single-ply roofing, lightweight fill, or tapered insulation low slope roof types.
1) C12 12 inch (305 mm) high Metal insulated curb
c. Flashing Options:
1) Curb Cap Insulation: Type CCI, Nominal 1 inch thick thermal insulation pad to reduce thermal conduction between curb-cap and tubing and thermal convection between room air and curb-cap. Rated R-6 (F x sqft x hr/Btu) Insulation is Polyisocyanurate foam utilizing CFC, HCFC, and HFC free blowing agent. Type-1 Class-1 per ASTM C 1289; Passes UL 1715 (15-minute thermal barrier per IBC 2603.4); Attic ventilation may be required per IBC 1203.2 (F x sqft x hr/Btu). For use with Flashing Type FC.
4. Transfer Zone:
a. Extension Tubes: Aluminum sheet, thickness 0.018 inch (0.5 mm) conforming to ASTM B 209.
1) Reflective Tubes:
a) Reflective extension tube, Type EXX and Type EL with total length of run as indicated on the Drawings.
b) Interior Finish: Spectralight Infinity with INFRAREDuction Technology combining ultra-high Visible Light reflectance with Ultra-low Infrared (IR) reflectance.
2) Tube Options
a) Top Tube Angle Adapter and Bottom Tube Angle Adapter Kit: Type AK, Reflective 45 degree adjustable top and bottom angle adapters (one each), 16 inches (406 mm) long
b) Bottom Tube Angle Adapter, Type BA: Reflective 45 degree adjustable Bottom Tube Angle Adapter, 16 inches (406 mm) long.
c) Reflective extension tube, Type EL: 48 inches (1220 mm) long, replaces two normal 24-inch (610 mm) extension tubes when long tube runs are required.

5. Delivery Zone:
   a. Diffuser Assemblies for Tubes Penetrating Ceilings: Solatube Model 750 DS-C. Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube; 23.8 inches by 23.8 inches (605 mm by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.
      1) Metal Transition Box: Type TM, Metal Round to Square transition box comprised of Spectralight Infinity SoftLight material with structured finish on exposed reflective surface, .015 in (0.4 mm) thick. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance with ASTM E308.
      2) Lens: Type L5 (Wide), OptiView Micro-replicated lens design to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.022 inch (0.6 mm) thick. Classified as CC2.

2.3 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions.

C. If substrate and rough opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Coordinate requirements for power supply, conduit, and wiring.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Coordinate installation with substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing to ensure that each element of the Work performs properly, and that finished installation is weather tight.
   1. Install flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.
   2. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.

3. Coordinate attachment and seal of perimeter air and vapor barrier material.

C. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, provide permanent separation as recommended by manufacturer

D. Align device free of warp or twist, maintain dimensional tolerances.

E. Inspect installation to verify secure and proper mounting. Test each fixture to verify operation, control functions, and performance. Correct deficiencies.

3.4 FIELD QUALITY CONTROL

A. Provide independent testing and inspection as specified in Section 01 45 23. Inspect installation to verify secure and proper mounting.
1. Test for water leaks in accordance with AAMA 502 after installation and curing of sealants but prior to installation if interior finishes.
2. Perform test for total area of each unit skylight.
3. Notify the Architect and the Contractor of any failed tests.

3.5 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
4. Division 28 Section “Access Control Hardware Devices”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and

special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

   a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

   1. Manufacturers:.

      a. Pemko (PE).

2.4 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

   1. Manufacturers:

      a. McKinney (MK) - QC (# wires) Option.

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

   1. Manufacturers:

a. Pemko (PE) - SER-QC (# wires) Option.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

   a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
   b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

   a. McKinney (MK) - QC-C Series.

2.5 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

   a. Rockwood (RO).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

   a. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.

5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

    a. Rockwood (RO).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy. Manufacturer shall be based in the United States of America.

1. Manufacturers:

    a. Sargent Manufacturing (SA).

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

F. Construction Keying: Provide construction master keyed cylinders.

G. Construction Keying: Provide temporary keyed construction cores.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:

a. Heavy duty 12-gauge wrought steel case.
b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1” projection deadbolt.
c. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
d. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
e. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
f. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 16 million cycles or greater.
g. Status indicators inside, outside, or on both sides of doors as specified; available with wording for “locked/unlocked”, “vacant/occupied” or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
h. Ten-year limited warranty for mechanical functions.

2. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.

2.9 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:

a. Meets ANSI/BHMA A156.41 for single motion egress.

b. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
d. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 20 million cycles or greater.
e. Exceeds ANSI/BHMA A156.2 requirements by 2.6 times for 3,100 in-lb. abusive locked lever torque with no entry while maintaining egress.
f. Exceeds ANSI/BHMA A156.2 requirements by 8 times for 1,600 lbs. offset lever pull with no entry for protection against attacks.
g. Exceeds ANSI/BHMA A156.3 requirements by 2 times for latch retraction with 100 lb. preload while maintaining operation in warped doors.
h. Exceeds ANSI/BHMA A156.3 requirements by 20 times for no access with minimum 100 vertical impacts for protection against vandalism attempts.
i. Independent return springs allow lock to exceed ANSI/BHMA A156.2 Grade 1 cycle requirements without lever sag.
j. Ten-year limited warranty for mechanical functions.

2. Electromechanical locksets shall have the following functions and features:

a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
c. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
d. Two-year limited warranty on electrified functions.

3. Manufacturers:

a. Sargent Manufacturing (SA) - 10X Line.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
11. Rail Sizing: Provide exit device rails factory sized for proper door width application.
12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:

    a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
    b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    c. Extended cycle test: Exit devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 5 million cycles or greater.
    d. Five-year limited warranty for mechanical features.

2. Electromechanical exit devices shall have the following functions and features:

a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
e. Five-year limited warranty for electromechanical features.

3. Manufacturers:

a. Sargent Manufacturing (SA) - 80 Series.

C. Steel Removable Mullions: ANSI/BHMA A156.3 steel removable mullions with options for fire rating, locking, through-wire electrification and hurricane compliance as specified.

1. Provide mullions with functions and features as follows:

a. Provide keyed removable feature where specified in the Hardware Sets.
b. Provide stabilizers and mounting brackets as required.

2. Manufacturers:

a. Same as exit device manufacturer.

2.12 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. Sargent Manufacturing (SA) - 351 Series.

C. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 422 Series.

2.13 ELECTROMECHANICAL DOOR OPERATORS

A. Electromechanical Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that are UL325/991 and UL10C certified and comply with requirements for the Americans with Disabilities Act (ADA). Operators shall accommodate openings up to 250 pounds and 48” wide.

1. Provide operators with features as follows:

a. Non-handed with push and pull side mounting.
b. Activation by push button, hands-free or radio frequency devices.
c. Adjustable opening force and closing power.
d. Two-year limited warranty.
e. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building’s IT required.
   1) Simple setup with no app required.
   2) View status and make adjustments without removing the cover.
   3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
f. Mounting backplate to simplify and speed up installation.
g. Integration with access control systems.

2. Operators shall have the following functionality:

a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
c. Emergency Interface Relay: Door closes and ignores any activation input until signal is discontinued.
d. Infinite Hold Open: Door will hold open at set position until power is turned off.
e. Latch Assist: At closed position, after an activation, the door is pulled in. After the door has closed, the door is pulled in to assist with latch release/engagement.
f. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
g. Open Delay: Delays operator opening for locking hardware.
h. Outside Wall Switch Disable: When contact is closed, outside wall switch is disabled.

i. Power Assist: Senses the door is being opened manually and applies small amount of power to assist the user in opening the door with force less than 5 lbs. The door opens only as far as it is moved manually, then closes once released.
j. Power Close: Additional force to assist door closing between 7° and 2°.
k. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
l. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
m. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
n. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
o. Executive Mode Feature: When the door receives an activation signal it opens and remains open until either a second signal is received, or the door is manually moved in closing direction.

3. Manufacturers:

a. Norton Rixson (NO) - 6300 Series.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

a. Rockwood (RO).

2.15 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will

impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

   a. Rockwood (RO).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

   1. Pemko (PE).

2.17 ELECTRONIC ACCESSORIES

2.18 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a

hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - SARGENT
5. RF - Rixson
6. NO - Norton
7. OT - Other

Hardware Sets

Set: 1.0
Doors: 200C, 200D, C101C

2	Continuous Hinge	CFM_SLF-HD1 SER		PE
1	Removable Mullion	L980S	PC	SA
1	Elec Rim Exit, Storeroom	43 55 56 64 8804 Less Pull	US32D	SA
1	Elec Rim Exit Device, Exit Only	43 55 56 8810 EO	US32D	SA
2	Large Format Inter Core	6300	US15	SA
1	Mullion Cylinder	64 980C1	US26D	SA
2	Door Pull	BF157	US32D	RO
2	Surface Closer	351 CPS	EN	SA
1	Gasketing	By Aluminum Frame Mfg.		OT
1	Mullion Gasketing	5110BL		PE
2	Sweep	315CN		PE
1	Threshold	171A or as detailed		PE
2	Door Wiring Harness	QC-Cxxx		MK
2	Frame Wiring Harness	QC-C1500P		MK
1	Card Reader	By Security Integrator		OT
2	Door Position Switch	By Security Integrator		OT
1	Power Supply	By Security Integrator		OT

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 2.0
Doors: V100A

2	Continuous Hinge	CFM_SLF-HD1 SER		PE
1	Removable Mullion	L980S	PC	SA
1	Elec Rim Exit, Storeroom	43 55 56 64 8804 Less Pull	US32D	SA
1	Elec Rim Exit Device, Exit Only	43 55 56 8810 EO	US32D	SA
1	Large Format Inter Core	6300	US15	SA

1	Mullion Cylinder	64 980C1	US26D	SA
2	Door Pull	BF157	US32D	RO
1	Surface Closer	351 CPS	EN	SA
1	Automatic Opener	6331	689	NO
1	Gasketing	By Aluminum Frame Mfg.		OT
1	Mullion Gasketing	5110BL		PE
2	Sweep	315CN		PE
1	Threshold	171A or as detailed		PE
2	Door Wiring Harness	QC-Cxxx		MK
2	Frame Wiring Harness	QC-C1500P		MK
2	Auto Opener Actuator	500 Series		NO
1	Card Reader	By Security Integrator		OT
1	Door Position Switch	By Security Integrator		OT
1	Power Supply	By Security Integrator		OT

Notes:

Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock. Exit device latch can be electrically held retracted for open access.
ADA access by actuator switch. In locked condition, actuator energized only upon valid card reader presentation.
Door remains locked when power fails.
Free to egress at all times. ADA egress by actuator switch.

Set: 3.0
Doors: V100B

2	Continuous Hinge	CFM_SLF-HD1		PE
2	Push Bar & Pull	BF15747	US32D	RO
1	Surface Closer	351 CPS	EN	SA
1	Automatic Opener	6331	689	NO
1	Astragal	By Aluminum Door Mfg.		OT
1	Gasketing	By Aluminum Frame Mfg.		OT
2	Auto Opener Actuator	500 Series		NO

Notes: Push actuator to use auto operator.

Set: 4.0
Doors: 200B, F106

4	Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
2	Elec Hinge, Hvy Wt	T4A3786 QCxx (Size as req'd)	US26D	MK
1	Removable Mullion	L980S	PC	SA
1	Elec Rim Exit, Fail Secure	43 55 64 8876 ETL	US32D	SA
1	Elec Rim Exit Device, Exit Only	43 55 8810 EO	US32D	SA
2	Large Format Inter Core	6300	US15	SA
1	Mullion Cylinder	64 980C1	US26D	SA
2	Surface Closer	351 CPS	EN	SA
2	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Astragal	355CS		PE
1	Gasketing	303AS		PE
1	Rain Guard	346A (as req'd)		PE
1	Mullion Gasketing	5110BL		PE
2	Sweep	315CN		PE
1	Threshold	171A or as detailed		PE
2	Door Wiring Harness	QC-Cxxx		MK

2	Frame Wiring Harness	QC-C1500P	MK
1	Card Reader	By Security Integrator	OT
2	Door Position Switch	By Security Integrator	OT
1	Power Supply	By Security Integrator	OT

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 5.0
Doors: A101B

2	Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1	Elec Hinge, Hvy Wt	T4A3786 QCxx (Size as req'd)	US26D	MK
1	Elec Rim Exit, Fail Secure	43 55 64 8876 ETL	US32D	SA
1	Large Format Inter Core	6300	US15	SA
1	Surface Closer	351 CPS	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Gasketing	303AS		PE
1	Rain Guard	346A (as req'd)		PE
1	Sweep	315CN		PE
1	Threshold	171A or as detailed		PE
1	Door Wiring Harness	QC-Cxxx		MK
1	Frame Wiring Harness	QC-C1500P		MK
1	Card Reader	By Security Integrator		OT
1	Door Position Switch	By Security Integrator		OT
1	Power Supply	By Security Integrator		OT

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 6.0
Doors: M100B

6	Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1	Auto Flush Bolt Set	2845/2945	US32D	RO
1	Dust Proof Strike	570	US26D	RO
1	Fail Secure Lock	RX 64 10XG71 LL	US26D	SA
1	Large Format Inter Core	6300	US15	SA
1	Coordinator	2600 Series x Brackets as req'd	Black	RO
2	Surface Closer	351 CPS	EN	SA
2	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Astragal	355CS		PE
1	Gasketing	303AS		PE
1	Rain Guard	346A (as req'd)		PE
2	Sweep	315CN		PE
1	Threshold	171A or as detailed		PE
1	Door Wiring Harness	QC-Cxxx		MK
1	Frame Wiring Harness	QC-C1500P		MK
1	Card Reader	By Security Integrator		OT
2	Door Position Switch	By Security Integrator		OT
1	Power Supply	By Security Integrator		OT

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 7.0
Doors: L100A, L101A, M102

2	Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1	Elec Hinge, Hvy Wt	T4A3786 QCxx (Size as req'd)	US26D	MK
1	Fail Secure Lock	RX 64 10XG71 LL	US26D	SA
1	Large Format Inter Core	6300	US15	SA
1	Surface Closer	351 UO	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Door Stop	406/409/441CU per condition	US26D	RO
1	Gasketing	303AS		PE
1	Rain Guard	346A (as req'd)		PE
1	Sweep	315CN		PE
1	Threshold	171A or as detailed		PE
1	Door Wiring Harness	QC-Cxxx		MK
1	Frame Wiring Harness	QC-C1500P		MK
1	Card Reader	By Security Integrator		OT
1	Door Position Switch	By Security Integrator		OT
1	Power Supply	By Security Integrator		OT

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 8.0
Doors: 102E, L100D, L101C

2	Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1	Elec Hinge, Hvy Wt	T4A3786 QCxx (Size as req'd)	US26D	MK
1	Fail Secure Lock	RX 64 10XG71 LL	US26D	SA
1	Large Format Inter Core	6300	US15	SA
1	Surface Closer	351 CPS	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Gasketing	303AS		PE
1	Rain Guard	346A (as req'd)		PE
1	Sweep	315CN		PE
1	Threshold	171A or as detailed		PE
1	Door Wiring Harness	QC-Cxxx		MK
1	Frame Wiring Harness	QC-C1500P		MK
1	Card Reader	By Security Integrator		OT
1	Door Position Switch	By Security Integrator		OT
1	Power Supply	By Security Integrator		OT

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.

Free to egress at all times.

Set: 9.0
Doors: 206B, 207

3	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Wireless CR Lock SA	60 IN100-10XG77-BIPS LL (Provided by Div. 28)	US26D	
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Surface Closer	351 UO	EN	SA
1	Door Stop	406/409/441CU per condition	US26D	RO
1	Gasketing	By Aluminum Frame Mfg.		OT
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 10.0
Doors: 206C

3	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Wireless CR Lock SA	60 IN100-10XG77-BIPS LL (Provided by Div. 28)	US26D	
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Surface Closer	351 CPS	EN	SA
1	Gasketing	By Aluminum Frame Mfg.		OT
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 11.0
Doors: 228A, 228B

6	Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1	Removable Mullion	L980S	PC	SA
1	Wireless CR Rim Exit Device SA	43 60 IN100-8877-BIPS ETL (Provided by Div. 28)		US32D
1	Rim Exit Device, Exit Only	43 8810 EO	US32D	SA
2	Large Format Inter Core	6300	US15	SA
1	Mullion Cylinder	64 980C1	US26D	SA
1	Construction Core	6400		SA
2	Surface Closer	351 UO	EN	SA
2	Kick Plate	K1050 10" high CSK BEV	US32D	RO
2	Door Stop	406/409/441CU per condition	US26D	RO
1	Mullion Gasketing	5110BL		PE
2	Silencer	608-RKW		RO
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 12.0
Doors: F107

6	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Fire Rated Removable Mullion	12-L980	PC	SA
1	Fire Rated Wireless CR Rim Exit SA	12 43 60 IN100-8877-BIPS ETL (Provided by Div. 28)		US32D
1	Fire Rated Rim Exit, Exit Only	12 43 8810 EO	US32D	SA
2	Large Format Inter Core	6300	US15	SA
1	Mullion Cylinder	64 980C1	US26D	SA
1	Construction Core	6400		SA
2	Surface Closer	351 UO	EN	SA
2	Kick Plate	K1050 10" high CSK BEV	US32D	RO
2	Door Stop	406/409/441CU per condition	US26D	RO
1	Gasketing	S88BL		PE
1	Mullion Gasketing	5110BL		PE
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 13.0
Doors: 217, A101A

3	Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1	Fire Rated Rim Exit, Passage	12 43 8815 ETL	US32D	SA
1	Surface Closer	422 CTB2	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Door Stop	406/409/441CU per condition	US26D	RO
1	Gasketing	S88BL		PE

Set: 14.0
Doors: 228C, 234, M101

6	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Auto Flush Bolt Set	2845/2945	US32D	RO
1	Dust Proof Strike	570	US26D	RO
1	Wireless CR Lock SA	60 IN100-10XG77-BIPS LL (Provided by Div. 28)		US26D
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Coordinator	2600 Series x Brackets as req'd	Black	RO
2	Surface Closer	351 UO	EN	SA
2	Kick Plate	K1050 10" high CSK BEV	US32D	RO
2	Door Stop	406/409/441CU per condition	US26D	RO
1	Astragal	355CS		PE
2	Silencer	608-RKW		RO
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 15.0
Doors: 108C, 108D

6	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Auto Flush Bolt Set	2845/2945	US32D	RO
1	Dust Proof Strike	570	US26D	RO
1	Wireless CR Lock SA	60 IN100-10XG77-BIPS LL (Provided by Div. 28)		US26D
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Coordinator	2600 Series x Brackets as req'd	Black	RO
2	Surface Closer	351 CPS	EN	SA
2	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Astragal	355CS		PE
2	Silencer	608-RKW		RO
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 16.0
Doors: 235

6	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Auto Flush Bolt Set	2845/2945	US32D	RO
1	Dust Proof Strike	570	US26D	RO
1	Wireless CR Lock SA	60 IN100-10XG77-BIPS LL (Provided by Div. 28)		US26D
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Coordinator	2600 Series x Brackets as req'd	Black	RO
2	Surface Closer	351 CPS	EN	SA
2	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Astragal	355CS		PE
1	Gasketing	S88BL		PE
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 17.0
Doors: 101A, 103A, 104A, 107A, 108A, 109A, 109D, 110A, 200, 201, 203A, 203D, 204A, 205A, 206A, 207A, 208, F100, F101, F102, J100, M100, R200P, S100, S101, S102

3	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK

1	Wireless CR Lock SA	60 IN100-10XG77-BIPS LL (Provided by Div. 28)		US26D
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Surface Closer	351 UO	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Door Stop	406/409/441CU per condition	US26D	RO
3	Silencer	608-RKW		RO
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 18.0
Doors: 105E, 106C

3	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Wireless CR Lock SA	60 IN100-10XG77-BIPS LL (Provided by Div. 28)		US26D
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Surface Closer	351 CPS	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Gasketing	S88BL		PE
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 19.0
Doors: L101F

3	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Wireless CR Lock SA	60 IN100-10XG77-BIPS LL (Provided by Div. 28)		US26D
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Surface Closer	351 CPS	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
3	Silencer	608-RKW		RO

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 20.0
Doors: 101C, 102A, 103B, 105A, 105B, 105D, 106A, 209, 210, 211, 212, 213, 218, 219, 220, 221, 223, 225, 226, 227, 229, 230, 231, E200O, J214, L201A, L201B, L202A, L203A, L204A, S222

4	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK

1	Wireless CR Lock	60 IN100-10XG77-BIPS LL (Provided by Div. 28)		US26D
	SA			
1	Large Format Inter Core	6300	US15	SA
1	Construction Core	6400		SA
1	Surface Closer	351 UO	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Door Stop	406/409/441CU per condition	US26D	RO
1	Gasketing	S88BL		PE
1	Hub	AH series (Provided by Div. 28)		SA

Notes: Operation Description:
Door normally closed, latched, and locked.
Presenting valid credential or key override to unlock.
Door remains locked when power fails.
Free to egress at all times.

Set: 21.0
Doors: R102, R103, R200A, R200B, R201, R202, R203, R204, R205, R206, R215, R216

4	Hinge	TA2714 (Size/NRP as req'd)	US26D	MK
1	Privacy Lock w/ Indicator	V21 8265 LNL	US32D	SA
1	Surface Closer	351 UO	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Door Stop	406/409/441CU per condition	US26D	RO
1	Gasketing	S88BL		PE

Set: 22.0
Doors: R100, R101

4	Hinge, Hvy Wt	T4A3786 (Size/NRP as req'd)	US26D	MK
1	Push Plate	70F	US32D	RO
1	Pull Plate	BF 110x70C	US32D	RO
1	Surface Closer	422 CTB2	EN	SA
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Door Stop	406/409/441CU per condition	US26D	RO
1	Gasketing	S88BL		PE

Set: 23.0
Doors: 101B, 102B, 102C, 102D, 103C, 104B, 105C, 105F, 106B, 107B, 108B, 109B, 110B, 203B, 203C, 203E, 203F, 204B, 205B, 232, C101A, C101B, L100B, L100C, L101B, L101D, L101E, L201C, L202B, L203B, L204B

1	Hardware	By Door Mfg.		OT

END OF SECTION 087100

SECTION 088000

SOLAR CONTROL INSULATING LOW-E COATED GLASS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Double-Glazed Solar Control Insulating Glass Units.

1.2 RELATED SECTIONS

1. Section 07 92 00 - Joint Sealants
2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts.
3. Section 08 44 13 - Glazed Aluminum Curtain Walls.

1.3 REFERENCES

A. ANSI Z 97.1 - Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

B. ASTM C 1036 - Standard Specification for Flat Glass.

C. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.

D. ASTM C 1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.

E. ASTM E 2188 – Standard Test Method for Insulating Glass Unit Performance.

F. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

G. CPSC 16CFR-1201 - Safety Standard for Architectural Glazing Materials.

H. Glass Association of North America (NGA/GANA) Glazing Manual.

1.4 DEFINITIONS

A. Sealed Insulating Glass Unit Surfaces:

1. Surface No. 1: Exterior surface of outer lite.

2. Surface No. 2: Interior surface of outer lite.

3. Surface No. 3: Exterior surface of inner lite.

4. Surface No. 4: Interior surface of inner lite.

B. Airspace: Space between lites of an insulating glass unit that contains dehydrated air or other inert specified gas.

1.5 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including performance characteristics and installation instructions.

C. Shop Drawings: Submit manufacturer's or fabricator's shop drawings, including plans, elevations, sections, and details, indicating glass dimensions, tolerances, types, thicknesses, and coatings.

D. Samples: Submit manufacturer's samples of each type, thickness, and coating.

E. Fabricator's Certification: Submit fabricator's certification by manufacturer.

F. Cleaning Instructions: Submit manufacturer's cleaning instructions.

G. Warranty: Submit manufacturer's standard warranty for sealed insulating glass units.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Minimum of 5 years experience manufacturing solar control coated glass.

B. Fabricator's Qualifications:

1. Minimum of 5 years experience manufacturing sealed insulating glass units meeting ASTM E 2190.

2. Certified by coated glass manufacturer.

C. Mock-Ups:

1. Comply with Section 01450 - Quality Control.

2. Obtain acceptance of mock-ups by Architect before proceeding with work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver glass to site in accordance with manufacturer's instructions.

2. Deliver glass in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:

1. Store glass in accordance with manufacturer's instructions.

2. Store glass in clean, dry area indoors.

3. Protect from exposure to direct sunlight and freezing temperatures.

4. Apply temporary coverings loosely to allow adequate ventilation.

5. Protect from contact with corrosive chemicals.

6. Avoid placement of glass edge on concrete, metal, and other hard objects.

7. Rest glass on clean, cushioned pads at 1/4-points.

C. Handling:

1. Handle glass in accordance with manufacturer's instructions.

2. Protect glass from damage during handling and installation.

3. Do not slide 1 lite of glass against another.

4. Do not use sharp objects near unprotected glass.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Guardian Glass, LLC, 2300 Harmon Road, Auburn Hills, Michigan 48326. Toll Free (866) 482-7374. Phone (248) 340-1800. Web Sites www.guardianglass.com.

B. Substitutions:

1. Must comply with provisions of Division 01 and be reviewed and deemed an approved equal.

2.2 FABRICATORS

A. Sealed Insulating Glass Units, Heat-Strengthened Glass, Tempered Glass, and Spandrel Glass:

1. Acceptable Fabricators: Certified by Guardian Glass, LLC to fabricate SunGuard Solar Control Coated Glass products.

- Glaz-Tech Industries, Inc.

2.3 SOLAR CONTROL INSULATING LOW-E COATED GLASS (1, 1T)

A. Double Sputter-Coated Insulating Glass Units:

1. Conformance: ASTM E 2190.

2. Outboard Lite: Sputter-coated **Guardian Gray Glass (North America)** glass.

a. **Guardian Gray Glass (North America)** Glass: ASTM C 1036, Type 1, Class **2,** Quality q3.

b. Vacuum Deposition Sputtered Coating: ASTM C 1376.

c. Coating on Surface No. 2: Guardian **No. 2: SunGuard® SNX 51/23 (North America).**

d. Glass Thickness: **1/4" (6mm).**

f. Heat Treatment: [None] [Heat-strengthened, ASTM C 1048, Kind HS] [Tempered; ASTM C 1048, Kind FT; CPSC 16CFR-1201; ANSI Z 97.1] as necessary to meet applicable codes and performance requirements.

3. Air Space: **1/2" (12.7mm)** wide, hermetically sealed, dehydrated **100% Air** space.

4. Inboard Lite: **Guardian Clear Glass (North America)** glass.

a. **Guardian Clear Glass (North America)** Glass: ASTM C 1036, Type 1, Class **1**, Quality q3.

b. Glass Thickness: **1/4" (6mm).**

c. Coating on Surface No. 4: Guardian **no coating**

d. Heat-Treatment: [None] [Heat-strengthened, ASTM C 1048, Kind HS] [Tempered; ASTM C 1048, Kind FT; CPSC 16CFR-1201; ANSI Z 97.1] as necessary to meet applicable codes and performance requirements.

5. Glass Unit Performance Characteristics:

a. Visible Light Transmittance: **26**

b. Visible Light Reflectance Outdoors: **7**

c. Winter U-Value Nighttime: **0.286**

d. Summer U-Value Daytime: **0.266**

e. Solar Heat Gain Coefficient: **0.16**

6. Edge Seals: ASTM E 2188, with aluminum spacers, dual-sealed with a primary seal of polyisobutylene and a secondary seal of silicone sealant for glass-to-spacer seals.

7. Sealant: Approved by glass manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive glass. Notify Architect of conditions that would adversely affect installation. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Verify glazing openings are correct size and within tolerance.

B. Verify glazing channels, recesses, and weeps are clean and free of obstructions.

3.3 GLAZING

A. Install glass in accordance with manufacturer's instructions, except where local codes or GANA Glazing Manual indicate more stringent requirements.

3.4 FIELD QUALITY CONTROL

A. Coated glass, when viewed from minimum of 10 feet, exhibiting slightly different hue or color not apparent in hand samples, will not be cause of rejection of glass units, as determined by Architect.

B. Verify glass is free of chips, cracks, and other inclusions that could inhibit structural or aesthetic integrity.

3.5 CLEANING

A. Clean glass promptly after installation in accordance with manufacturer's instructions.

B. Remove labels from glass surface.

C. Do not use harsh cleaning materials or methods that would damage glass.

3.6 PROTECTION

A. Protect installed glass from damage during construction.

B. Protect installed glass from contact with contaminating substances resulting from construction operations.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

Calculated Values are in accordance with NFRC 2010

Manufacturer:

Guardian Glass

Global and North American Headquarters

2300 Harmon Road

Auburn Hills, MI 48326

United States

Web: www.guardinglass.com

Tel: +1 248-340-1800

Email: guardianglass@guardian.com

The products in this publication are sold subject to Guardian‘s standard terms and conditions of sale and any applicable written warranties (available at www.guardianglass.com or from your local Guardian representative upon request). It is the responsibility of the purchaser to confirm that the products are suitable for their intended application in compliance with the applicable laws and regulations. Please contact your local Guardian representative to obtain any applicable handling and fabrication guides and for the most current product information.

SECTION 08 81 00
FIRED-RATED GLAZING

Part 1 – General

1.1 Summary
- A. Section Includes:
  1. Fire-rated glazing materials intended for use in door lights, transoms, windows and sidelites in fire-rated frames.
- B. Related Sections:
  1. Section 08 11 00 – Metal Doors and Frames
  2. Section 08 12 00 – Metal Frames
  3. Section 08 13 00 – Metal Doors
  4. Section 08 14 00 – Wood Doors
  5. Section 08 51 00 – Metal Windows
  6. Section 08 52 00 – Wood Windows

1.2 References
- A. UL 9 – Fire Tests of Window Assemblies
- B. UL 10B – Fire Tests of Door Assemblies
- C. UL 10C – Positive Pressure Fire Tests of Door Assemblies
- D. UBC 7-2 – Positive Pressure Standard
- E. UBC 7-4 – Fire Test of Window Assemblies
- F. NFPA 80 – Fire Doors and Windows
- G. NFPA 252 – Fire Tests of Door Assemblies
- H. NFPA 257 – Fire Tests of Window Assemblies
- I. ULC CAN4-S104 – Fire Tests of Door Assemblies
- J. ULC CAN4-S106 – Fire Tests of Window Assemblies

1.3 Performance Requirements
- A. Fire- and safety-rated glass-ceramic, clear and wireless with a surface-applied film, for use in door lights, transoms or sidelights and windows with fire rating requirements from 20 minutes to 90 minutes (180 minutes in doors) with hose stream test in impact safety-rated locations.
- B. Conforms to positive pressure test standards.
- C. Environmentally-friendly glass-ceramic product and manufacturing process
  1. Conservation of energy and water in manufacturing process: 20% electricity from renewable sources, gray water replaces 90 % of process water, all process water recirculated
  2. Raw material batch includes 40 – 50 % recycled cullet sourced internally and from cut-offs and scrap returned from fabricators
  3. Environmentally friendly glass-ceramic contains no hazardous heavy metals such as Antimony or Arsenic.

1.4 Submittals
- A. Comply with requirements of Section 01 30 00.
- B. Product data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.
  1. Certificate of Compliance from glazing material fabricator attesting that glazing materials furnished for project comply with CPSC requirements. Glazing materials bear manufacturers permanent label designating type of glass, fire rating and UL Mark. Provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.
  2. Product test listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.
- C. Samples: Submit, for verification and approval purposes.

1.5 Quality Assurance

A. Glazing standards: GANA Glazing Manual and GANA Sealant Manual
B. Fire-rated glass: Each lite shall bear a permanent, non-removable label from Underwriters Laboratories certifying it for use in tested and rated fire-protective assemblies.

1.6 Delivery, Storage and Handling
A. Deliver, store and handle materials under provision of Section 01 60 00.
B. Deliver materials to specified destination in manufacturers or distributors packaging, undamaged, complete with installation instructions.
C. Store off ground, under cover, protected from weather and construction activities.

1.7 Warranty
Provide manufacturers limited warranty under provision of Section 01 70 00.

Part 2 – Products

2.1 Fire-Rated Glazing Materials (2, 2T, 2TF)
A. Manufacturer: PYRAN® Platinum F fire- and safety rated glass-ceramic manufactured by SCHOTT Technical Glass Solutions GmbH, Jena, Germany and supplied by SCHOTT North America, Inc., Louisville, KY, Telephone 1.502.657.4439, Fax 1.502.966.4976. Acceptable suppliers: Glaz-Tech Industries, Inc.
B. Properties:
4. Thickness: 3/16” (5 mm)
5. Film: surface-applied safety film
6. Weight: 2.5 lbs/ft².
7. Clear; No amber tint
8. Visible light transmission: approximately 80 % according to test standard DIN EN 410
9. Fire-rating: Up to 90 minutes (up to 180 minutes in doors) with hose stream test
10. Impact safety rating: ANSI Z97.1 (Class A) and CPSC 16CFR1201 (Cat. I and II).
11. Manufactured by a special float process resulting in smooth surface finish
12. Environmentally friendly glass-ceramic contains no hazardous heavy metals such as Antimony or Arsenic.
C. Maximum sheet sizes: Approximately 51” x 99”
D. Labelling: Permanently label each lite of PYRAN® Platinum F fire- and safety-rated glass-ceramic with product and manufacturers name, UL-mark, fire rating, etc., according to code requirements.
1. Optional: Glazing may be lightly sandblasted or may be decorated with surface-applied opacity film. After the surface treatment, a Clearshield coating may be applied.
2. The glazing units may be directly screen-printed upon.
E. Fire Rating: Fire rating tested and listed by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with UL 9, UL 10C, UBC 7-2, UBC 7-4, NFPA 252, NFPA 257, ULC CAN4-S106 and ULC CAN4-S106.

2.2 Glazing Compound
A. Glazing tape: Closed cell polyvinyl chloride (PVC) foam, Pemko Manufacturing Company, Ref. FG3000S90 or Unifrax Corporation Fiberfrax Alumino-Silicate fiber glazing tape.
B. Setting blocks: Calcium silicate
C. Cleaners, primers and sealers: Type recommended by manufacturer of glass and gaskets.

2.3 Fabrication
A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

Part 3 – Execution

3.1 Examination
A. Examine glass and framing, with glaziers present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
2. Minimum required face or edge clearances.
3. Observable edge damage or surface imperfections.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.
C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.2 Installation (glazing)

A. Comply with referenced GANA manuals and instructions of manufacturers of glass, glazing sealants and glazing compounds.
B. Protect glass from edge damage during handling and installation. Inspect glass during installation and set aside pieces with edge damage that could affect the performance.
C. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
D. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
E. Arrange two setting blocks located at quarter points of glass with edge block no more than six inches from corners.
F. Glaze vertically into labelled fire-rated metal frames or partition walls with the same fire rating as the glass and push against tape for full contact at perimeter of pane or unit.
G. Place glazing tape on free perimeter of glazing in same manner described above.
H. Install removable stop and secure without displacing the tape.
I. Install so that appropriate markings remain permanently visible.

3.3 Protection and cleaning

A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by methods approved by the glass manufacturer.
B. Wash glass on both surfaces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass with a soft, clean, non-abrasive cloth and a mild soap, detergent, or non-abrasive window cleaning solution. After cleaning, rinse immediately with clean water and remove any excess water from the panel surface. Do not allow any metal parts of the cleaning equipment to come in contact with the panel surface.

3.4 Glazing schedule Rating

Rating	Application	Max. exposed area of glazing in. (m²)	Max. width of exposed glazing in. (mm)	Max. height of exposed glazing in. (mm)	Min. depth of groove in. (mm)	Groove Width In.	Building Code Marking
Up to 90 min	Doors Non-Temp Rise	3708 (2.39 m²)	36” (914 mm)	76” (1930 mm)	5/8” (16 mm)	7/16” 3/8”	D-H-NT-90
Up to 180 min	Doors Temp Rise and Non-Temp Rise	100” (0.0645 m²)	12” (305 mm)	33” (838 mm)	½” (12.7 mm)	7/16” 3/8”	D-H-NT-180
Up to 90 min	Transom lites, sidelites, windows	4933” (3.183 m²)	98 ¼” (2495 mm)	98 ¼” (2495 mm)	5/8” (16 mm)	7/16” 3/8”	OH-90

End of Section

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. Related Sections include the following:

1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
2. Division 07 Section "Thermal Insulation" for insulation installed with Z-shaped furring members.
3. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non- load-bearing steel framing.
4. Division 09 Section "Gypsum Plastering" for metal lath supported by non-load-bearing steel framing.
5. Division 09 Section "Portland Cement Plastering" for metal lath supported by non-load-bearing steel framing.
6. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 4.1[**and Credit MR 4.2**]: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre - consumer recycled content.

C. Include statement indicating costs for each product having recycled content.

D. Product Data: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load- bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641 M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

1. Depth: 2-1/2 inches

D. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges, 3/4 inch deep.
2. Steel Studs: ASTM C 645.

a. Minimum Base-Metal Thickness: 20 gauge.

b. Depth: 3-5/8”

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base Metal Thickness: 0.0312 inch

4. Resilient Furring Channels: 1/2-inch deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical or hat shaped

E. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; 640-C Drywall Furring System.
c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: .0396 inch (1.0 mm) (2o0 gauge)
2. Depth: As indicated on Drawings

B. Slip-Type Head Joints: At all wall – to – structure connections, provide one of the following:
1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
b. Products: Subject to compliance with requirements, provide one of the following:

1) Steel Network Inc. (The); VertiClip SLD VertiTrack VTD Series.
2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire -resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
b. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0312 inch .

E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches , 0.068-inch thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 18 gauge
2. Depth: 1-1/2 inches.

G. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

H. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare - steel thickness of 0.0312 inch .
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches , wall attachment flange of 7/8 inch , minimum bare-metal thickness of 0.0179 inch , and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow -metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire -resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard

suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
b. Multilayer Application: 16 inches o.c., unless otherwise indicated.
c. Tile backing panels: 16 inches o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.

b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire -resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

D. Direct Furring (hat channels):

1. Screw to metal or wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners or pre-drilled fasteners spaced 12 inches o.c., staggered (on each leg of channel)

E. Z-Furring Members:

1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches 600 mm o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.6 WASTE MANAGEMENT

A. Separate unused metals for recycling in accordance with requirements of Division 01 Section "Construction Waste Management."

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements that affect gypsum board and related products.
2. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
3. Division 06 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
4. Division 06 Section "Sheathing" for gypsum sheathing.
5. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
6. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board.
7. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
8. Division 09 Section "Gypsum Board Shaft-Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
9. Division 09 Section "Gypsum Veneer Plastering" for gypsum base for veneer plaster and for other components of gypsum-veneer-plaster finishes.
10. Division 09 Section "Tiling" for cementitious backer units installed as substrates for ceramic tile.
11. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and

on same backing indicated for Work.

C. LEED Submittals:

1. Product Data for Credit MR 4.1[**and MR 4.2**]: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre -consumer recycled content.
   a. Include statement indicating costs for each product having recycled content.

2. Product Data for Credit EQ 4.1: For adhesives used to laminate gypsum board panels to substrates, including printed statement of VOC content.

1.4 QUALITY ASSURANCE

A. Identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

   a. Each level of gypsum board finish indicated for use in exposed locations.
   b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to,

discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Gypsum Co.
b. BPB America Inc.
c. G-P Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple.
h. USG Corporation.

B. Regular Type:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured rounded or beveled for prefilling.

C. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured rounded or beveled for prefilling.

D. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.

E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

F. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation,

through - penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

G. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).

1. Core: 5/8 inch thick
2. Plastic-Film Thickness: 0.081 inch.

H. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch , Type X.
2. Long Edges: Tapered.

2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Gypsum Co.
   b. BPB America
   c. Inc. G-P Gypsum.
   d. Lafarge North America Inc.
   e. National Gypsum Company.
   f. PABCO Gypsum.
   g. Temple.
   h. USG Corporation.

3. Core: 5/8 inch, Type X.

B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum.
2. Core: 5/8 inch, Type X.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Custom Building Products; Wonderboard.

b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
c. USG Corporation; DUROCK Cement Board.
d. Insert manufacturer's name; product name or designation.

3. Thickness: 1/2 inch.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fry Reglet Corp.
b. Gordon, Inc.
c. Pittcon Industries.

3. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 Alloy 6063-T5.
4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified

D. Cloud Edge Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following: (Basis of Design is Armstrong Axiom Extruded Aluminum Trims, Perimeters, and

Transitions)

a. Armstrong World Industries, inc.
b. USG
c. Flannery Trim

3. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 Alloy 6063-T5.
4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
3. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum

panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

2.8 TEXTURE FINISHES

NOTE: All Gypsum Board in facility to receive Level 5 finish

A. Primer: As recommended by textured finish manufacturer.

B. Roll-applied finish texture coating in accordance with manufacturer’s instructions .

1. Texture: Fine-Nap Rolled where applicable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Regular Type: As indicated on Drawings.
2. Type X: As indicated on Drawings
3. Flexible Type: As indicated on Drawings
4. Ceiling Type: Ceiling surfaces.
5. Foil-Backed Type: As indicated on Drawings.
6. Abuse-Resistant Type: As indicated on Drawings.
7. High-Impact Type: As indicated on Drawing]
8. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board applicati on to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically parallel to framing unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

   b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base- layer joints, unless otherwise indicated or required by fire -resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face -layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws .

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPL YING EXTERIOR GYPSU M PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural

penetrations.
2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect. Under no circumstances shall spacing exceed 30’ o.c.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners[, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated
4. U-Bead: Use at exposed panel edges] [where indicated.
5. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 2: Panels that are substrate for tile] [Panels that are substrate for acoustical tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

5. Level 5: [At all walls scheduled to receive wall paper or painted finish in public areas, office areas, main corridors of administration building.].

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture[matching approved mockup and] free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.9 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.10 WASTE MANAGEMENT

A. Separate clean waste gypsum and metal products from contaminants for recycling in accordance with theWaste Management Plan in Division 01 Section "Construction Waste Management." Do not include plastic, asphalt impregnated gypsum board or gypsum board coated with glass fiber, paint or other finish.
Place in designated area and protect from moisture and contamination.

END OF SECTION

SECTION 09 30 00
TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile and Accessories:
1. Modern Dimensions Wall Tile
2. Glazed Ceramic Wall Tile
3. ColorBody Porcelain Tile
4. Trim and Accessories.
5. Setting Materials.

1.2 RELATED SECTIONS

A. Division 3 - Self-Leveling Underlayment.

B. Division 7 - Joint Sealant.

1.3 REFERENCES

A. American National Standards Insitute (ANSI):
1. ANSI A108.1A, 1999 - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
2. ANSI A108.1B, 1999 - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
3. ANSI A108.1C, 1999 - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet- Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland
Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
4. ANSI A108.4, 1999 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water- Cleanable Tile Setting Epoxy Adhesive.
5. ANSI A108.5, 1999 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
6. ANSI A108.6, 1999 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water- Cleanable Tile-Setting and -Grouting Epoxy.
7. ANSI A108.8, 1999 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar
and Grout.
8. ANSI A108.9, 1999 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
9. ANSI A108.10, 1999 - Specifications for Installation of Grout in Tilework.
10. ANSI A118.1, 1999 - Standard Specification for Dry-Set Portland Cement Mortar.
11. ANSI A118.3, 1999 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
12. ANSI A118.4, 1999 - Latex-Portland Cement Mortar.
13. ANSI A118.5, 1999 - Chemical-Resistant Furan Mortar and Grout.
14. ANSI A118.6, 1999 - Standard Ceramic Tile Grouts.
15. ANSI A118.7, 1999 - Polymer Modified Cement Grouts
16. ANSI A118.8, 1999 - Modified Epoxy Emulsion Mortar/Grout.
17. ANSI A118.9, 1999 - Test Methods and Specifications for Cementitious Backer Units
18. ANSI A118.10, 1999 - Load bearing, Bonded, Waterproof Membranes for Thinset Ceramic Tile and Dimensional Stone.
19. ANSI A118.11, 1999 - Exterior Grade Plywood (EGP) Latex-Portland Cement Mortar.
20. ANSI A136.1, 1999 - Organic Adhesives for Installation of Ceramic Tile.
21. ANSI A137.1, 1988 - Specifications for Ceramic Tile.

B. ASTM International (ASTM):
1. ASTM C 50 - Standard Specification for Portland Cement.
2. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.

3. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
4. ASTM C 241 - Test Method For Abrasion Resistance of Stone Subjected to Foot Traffic.
5. ASTM C 503 - Specification for Marble Building Stone (Exterior).
6. ASTM C 615 - Specification for Granite Dimension Stone.
7. ASTM C 629 - Specification for Slate Dimension Stone.
8. ASTM C 847 - Standard Specification for Metal Lath.
9. ASTM C 1028 - Test method for Determining the Static Coefficient of Friction or Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull meter Method.
10. ASTM D 4397 - Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

C. Tile Council of North America (TCNA): TCA Handbook for Ceramic Tile Installation, 2007.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
1. Level Surfaces: Minimum of 0.6 (Wet).
2. Step Treads: Minimum of 0.6 (Wet).
3. Ramp Surfaces: Minimum of 0.8 (Wet).

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. [Product Data]: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories , and setting details.

D. Selection Samples: Color charts illustrating full range of colors and patterns.

E. Selection Samples: Samples of actual tiles for selection.

F. Samples: Mount tile and apply grout on two plywood panels, illustrating pattern, color variations, and grout joint size variations.

G. Manufacturer's Certificate:
1. Certify that products meet or exceed specified requirements.
2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the
manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.

H. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

I. LEED Submittals:

1. Credit EQ 4.1: Manufacturer’s product data for adhesives and sealants, including printed statement of VOC content.

2. Materials and Resources (MR), Credit 4, Recycled Content: Manufacturer's or fabricator's certificate indicating percentage of postconsumer recycled content by weight and post-industrial recycled content by weight for each product specified under this section. Include

statement indicating cost for each product having recycled content.

3. Materials and Resources (MR), Credit 5, Regional Materials : For products and materials required to comply with requirements for regional materials indicating location and distance from project of
material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum two years experience.

B. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.

C. Mockups: Build 4' x 4' mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging until ready for installation.

B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.

C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during tiling and for a minimum of 7 days after completion.

1.9 EXTRA MATERIALS

A. Provide for Owner's use a minimum of 2 percent of the primary sizes and colors of tile specified, boxed and clearly labeled.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. DalTile Corporation, located at 5601 Venice Ave NE; Albuquerque, NM 87113; Telephone (505) 884-0017.

B. Substitutions will be considered in accordance with the provisions of Division 1.

2.2 TILE

A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
   1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
   2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with
      the manufacturer, unless otherwise specified.

B. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.

C. PTF: PORCELAIN TILE FLOORING:
   1. Product: Daltile, Outlander in Dusk Rectangle Palazzo
   2. Moisture Absorption: Less than .5 percent to less than 20 percent.
   3. Size and Shape: Thickness 5/16”, 12”x24” Floor Tile
   4. Surface Finish: Matte
   5. Shade Variation: Medium (V2)
   6. Color: OU58 DUSK
   7. Grout Joint Recommendation and Color: 1/8”, MAPEI 106 Walnut
   8. Pattern: As indicated on the Drawings.
   9. Trim Units: Matching bullnose, cove base corner, cove base out corner, jolly, grooved bullnose, cement bullnose, fabric bullnose, shapes in sizes coordinated with field tile.

D. CTW-1: GLAZED CERAMIC TILE WALL (BASE COLOR)
   1. Product: Daltile, Rigid Clay in Rock Plateau
   2. Moisture Absorption: Less than .5 percent to less than 20 percent.
   3. Size and Shape: Thickness 5/16”, 12”x24”
   4. Surface Finish: Matte
   5. Shade Variation: V2: Medium
   6. Color: RC12 Rock
   7. Grout Joint Recommendation and Color: 1/8”, MAPEI 103 Cobblestone
   8. Pattern: As indicated on the Drawings.
   9. Trim Units: Matching bullnose, cove base corner, cove base out corner, jolly, grooved bullnose, cement bullnose, fabric bullnose, shapes in sizes coordinated with field tile.

E. CTW-2: GLAZED CERAMIC TILE WALL (ACCENT COLOR IN GANG RESTROOMS)
   1. Product: Daltile, Multitude – Urban Grey Rectangle Wave
   2. Moisture Absorption: Less than .5 percent to less than 20 percent.
   3. Size and Shape: Thickness 3/8”, 12”x24”
   4. Surface Finish: Textured
   5. Shade Variation: V1: Low
   6. Color: MU18 Urban Grey wave
   7. Grout Joint Recommendation and Color: 1/8”, MAPEI 103 Cobblestone
   8. Pattern: As indicated on the Drawings.
   9. Trim Units: Matching bullnose, cove base corner, cove base out corner, jolly, grooved bullnose, cement bullnose, fabric bullnose, shapes in sizes coordinated with field tile.

F. CTW-3: CERAMIC TILE WALL (ACCENT COLOR IN SINGLE OCCUPANT RESTROOMS)
   1. Product: Daltile, Industrial Metals Iron
   2. Moisture Absorption: Less than .5 percent to less than 20 percent.
   3. Size and Shape: Thickness 5/16”, 3”x6”
   4. Surface Finish: Satin
   5. Shade Variation: V2: Medium
   6. Color: IM21 Iron Rectangle Grooved
   7. Grout Joint Recommendation and Color: 1/8”, MAPEI 47 Charcoal
   8. Pattern: As indicated on the Drawings.

9. Trim Units: Matching bullnose, cove base corner, cove base out corner, jolly, grooved bullnose, cement bullnose, fabric bullnose, shapes in sizes coordinated with field tile.

2.3 TRIM, NOSING AND ACCESSORIES

A. Non-Ceramic Trim: Schluter Systems L.P. Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive; use in the following locations:
   1. Open edges of floor tile.
   2. Transition between floor finishes of different heights.
   3. Thresholds at door openings.
   4. Expansion and control joints, floor and wall.

B. Metal outside corner trim and metal bullnose Wainscot trim: RONDEC-AT corner trim, including inside and outside corner pieces, satin nickel anodized aluminum.

C. Metal floor transition trim: RENO-TK protective edge trim, height as required to flush out with flooring, satin nickel anodized aluminum.

D. Metal Slip resistant nosing: Schluter Systems TREP-E profile, roll formed stainless steel , Type 304, profile with ribbed, 1-3/16” inch wide exposed surface with rounded leading edge, and integrated trapezoid - perforated anchoring leg.
   1. Height as required.
   2. Matching end caps at exposed ends..

2.4 SETTING MATERIALS

A. Epoxy Adhesive: ANSI A118.3, thinset bond type.

B. Mortar Bed Materials:
   1. Portland cement: ASTM C150, type 1, gray or white.
   2. Hydrated Lime: ASTM C207, Type S.
   3. Sand: ASTM C144, fine.
   4. Latex additive: As approved.
   5. Water: Clean and potable.

C. Mortar Bond Coat Materials:
   1. Dry-Set Portland Cement type: ANSI A118.1.
   2. Latex-Portland Cement type: ANSI A118.4.
   3. Epoxy: ANSI A118.3, 100 percent solids.

D. Polymer modified cement grout, sanded or unsanded, as specified in ANSI A118.7; BY Laticrete; color to be selected from manufacturer’s full line of available colors.

E. Epoxy Grout: ANSI A118.8, 100 percent solids epoxy grout for all work in wet locations, BY Laticrete; color to be selected from manufacturer’s full line of available colors .

F. Silicone Sealant: Silicone sealant, moisture and mildew resistant

G. Cleavage Membrane:
   1. Polyethylene film, ASTM D4397, 4.0 mil thickness.

H. Waterproofing Membrane at Floors: Membrane in accordance with ANSI A118.10 and as follows:
   1. Chlorinated Polyethylene Sheet with polyester fabric reinforcing.

I. Membrane at Walls: 4 mil (0.1 mm) thick polyethylene film, ASTM D4397.

J. Reinforcing Mesh: 2 by 2 inch (50 by 50 mm) size weave of 16/16 wire size; welded fabric, galvanized.

K. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced with 2 inch (50 mm) wide coated glass fiber tape for joints and corners:
   1. Thickness: 1/2 inch (13 mm).

2.5 SHOWER PAN

A. Composeal Gold 40-mil Waterproof Membrane by Compotite Corp: Chloraly 240 Shower Pan Liner as manufactured by Noble Co. or equal. Provide a 40-mil crack isolation waterproofing sheet membrane.

2.6 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product complying with ANSI A 118.12 for standard performance and is Recommended by the manufacturer for the application indicated.
   1. Contractor's option: Chlorinated Polyethylene sheet: Non-plasticized elastomer wth non-woven
   polyester laminated to both sides, nominal .030" thickness by Noble Seal CIS; Noble Co.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.

B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.

C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Remove any curing compounds or other contaminates.

C. Vacuum clean surfaces and damp clean.

D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

E. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.

B. Install glass tile with high-performaning ANSI A118.4 or ISO C251 or better mortars to achieve adhesion. Install per manufacturer recommendations.

C. Minimal cuts recommended on large format glass tile, reference manufacturer's and TCA

handbook for proper installation.

D. Lay tile to pattern indicated. Arrange pattern so that a full tile or joint is centered on each wall and that no tile less than ½ width is used. Do not interrupt tile pattern through openings.

E. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

G. Form internal angles square and external angles bullnosed.

H. Install ceramic accessories rigidly in prepared openings.

I. Install non-ceramic trim in accordance with manufacturer's instructions.

J. Sound tile after setting. Replace hollow sounding units.

K. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

L. Allow tile to set for a minimum of 48 hours prior to grouting.

M. Grout tile joints. Use standard grout in all areas except for epoxy grout at restrooms, showers, and other areas prone to contact with water (backsplash, sidesplash, etc.).

1. Finished grout to be uniform in color, smooth and without voids and low spots. Grout joint width as recommended by tile manufacturer.

N. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

1. Shower pan membrane installation:

2. Coat surface to receive membrane waterproofing with a minimum 3/16” coat of bond coat adhesive and in accordance with manufactrurer’s recommendation and ANSI A 108.5.

3. Provide PVC solvent cement welding of all seams and penetrations including drains.

4. Provide factory fabricated pre-molded inside and outside corners.

O. Shower wall tile base: Install tile backer board. Apply with un-cut long edge at bottom of work. Fasten boards to steel stud framing with Type S bugle head drywall scres spaced 6” o.c. Space fasteners at least 3/8” from edge of board.

P. Concrete slab-on-grade: Install crack isolation membrane to comply with ANSI A108.17 and manufacturer’s written instructions and recommendations to produce membrane bonded securely to substrate.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex- portland cement bond coat, with standard grout, unless otherwise indicated.
1. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with latex-portland cement grout.
2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F131.

3.5 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F111, with cleavage membrane, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCA Handbook Method F121.
   2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method
      F132, bonded.
   3. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCA Handbook Method F114, with cleavage membrane.

B. Cleavage Membrane: Lap edges and ends.

C. Waterproofing Membrane: Install as specified in ANSI A108.13.

D. Mortar Bed Thickness: 1-1/4 to 2 inch (32 to 51 mm) maximum, unless otherwise indicated.

3.6 INSTALLATION - WALL TILE AND CEILINGS

A. Over cementitious backer units on studs, install in accordance with TCA Handbook Method W244, using membrane at toilet rooms.

B. Over interior concrete and masonry install in accordance with TCA Handbook Method W202, thin-set with dry-set or latex-portland cement bond coat.

3.7 FLOOR TILE ADHESIVE/ WATERPROOFING MEMBRANE:

A. At second floor level use adhesive/ waterproof membrane as per ANSI A108.13 and manufacturer's written instructions and recommendations.

B. All vertical surfaces and penetrations shall receive integral flashing made by coating both vertical and horizontal surfaces with 30-50 mils of adhesive/ waterproof membrane. Extend not less than 4" up and out from the juncture. Allow to set and then embed woven glass fiber scrim and recoat with 50-75 mils of adhesive/ waterproof membrane.

C. Use serrated mason's trowel to apply adhesive/waterproof membranes at a rate to achieve a thickness of not less than 1/16". Cove tile shall be placed first, followed by floor tile.

D. Set tile as the adhesive/waterproof membrane is spread . Press and beat tile firmly into place to establish proper and complete bond. Joints shall be close and uniform.

3.8 METAL FLOOR TRANSITION TRIM:

A. Provide at transition of floor tile to lower flooring material.

B. Install as per manufacturer's recommendations.

C. Set trim prior to installing floor tile. Trim to be flush with top of tile.

D. Fill joint between trim and ceramic tile with sealant to match grout.

3.9 METAL CORNER AND EDGE TRIM:

A. Provide at all outside and inside corners of wall tile.

B. Set metal trim prior to installing wall tile.

C. Install tile up to corner trim with a factory cushion edge, provide a 1/8" joint between tile and trim. Trim shall be flush with faces of ceramic tile.

D. After tile work and grout are dry, clean joint between the trim and the tile, fill joint with sealant to match grout.

3.10 CLEANING

A. Clean tile and grout surfaces.

3.11 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished floor surface for 72 hours after installation.

B. Cover floors with kraft paper and protect from dirt and residue from other trades.

C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways

D. Replace cracked, broken and chipped tile with new units and correct uneven and stained joints.

3.12 SCHEDULE

A. See Drawings.

PTF: Outlander - Dusk Rectangle Palazzo
CTW-1: Rigid Clay - Rock Plateau
CTW-2: Multitude - Urban Grey Rectangle Wave
CTW-3: Industrial Metals - Iron Rectangle Grooved

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
2. Division 09 Section "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with concealed suspension systems, stapling, or adhesive bonding.
3. Division 09 Section "Acoustical Metal Pan Ceilings."
4. Division 09 Section "Linear Metal Ceilings."
5. Division 09 Section "Suspended Decorative Grids."
6. Alternates
   a. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date
   established for receipt of bids. Acceptability of a proposed substitution is contingent upon the
   Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products which have not been approved by Addenda, the specified products shall be provided without additional compensation.
   b. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Panel design, size, composition, color, and finish; Suspension system comp o- nent

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension system members.
2. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1/8 inch = 1 foot.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch long Samples of each type, finish, and color.

E. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for sealants, including printed statement of VOC content and material safety data sheets.

2. Materials and Resources (MR) Credit 4, Recycled Content.

3. Materials and Resources (MR), Credit 5, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

F. Qualification Data: For testing agency.

G. Field quality-control test reports.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

I. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.

J. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Fire-Resistance Ratings:Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency
b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A, B, C, materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recom mendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies -- Seismic Zones 3 & 4."
4. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."
5. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
6. Insert requirement of authorities having jurisdiction.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in

Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire -suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

1. Refer to Section 1.11 below

1.10 WARRANTY

A. Acoustical Panels: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical clouds that fail within the warranty period. Failures include, but are not limited to:

1. Acoustical panels: Manufacturing defects
` 2. Attachment devices: Rusting and manufacturing defects.

B. Warranty Period:

1. Acoustical Panels: Ten (10) years from date of Substantial Completion
2. Attachment devices: Ten (10) years from date of Substantial Completion

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the contrac- tor under the requirements of the Contract Documents.

1.11 MAINTENANCE

A. Extra Materials: Deliver extra material to Owner. Furnish extra materials described below that match prod- ucts installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount

installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed suspension comp o- nent equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

2. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

B. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram - positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

C. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.; Ultima 1915 Non-directional or equal.
2. Surface Texture: Fine fissured
3. Composition: Mineral Fiber
4. Color: White
5. Size: 24 inches x 48 inches and 24 inches x 24 inches
6. Thickness: 3/4 inches
7. Edge Profile: Beveled Tegular 9/16 inches
8. Noise Reduction Coefficient (NRC): 0.70
9. Ceiling Attenuation Class (CAC): 35
10. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.90
11. Antimicrobial Protection: Bio Block +

C. Products: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.; Cirrus Second Look III-514 or equal.
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24 inches x 48 inches
6. Thickness: 3/4 inches
7. Edge Profile: Beveled Tegular 9/16 inches
8. Noise Reduction Coefficient (NRC): 0.65
9. Ceiling Attenuation Class (CAC): 35
10. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.85
11. Antimicrobial Protection: Bio Block +

D. Products: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.; Metal Works Mesh^{tm} or equal.
1. Composition: Expanded Metal – Square Lay-in 15/16 – Pattern: Lattice Item 6136W24L24 (73% Open), 6136W24L48 (73% Open), 6136W24L72 (73% Open)
2. Color: Nickel Chrome
3. Size: 24 inches x 24 inches; 24 inches x 48 inches and 24 inches x 72 inches.
4. Thickness: 1/4 inches
5. Edge Profile: Square Lay-in 15/16
6. Noise Reduction Coefficient (NRC): 0.70-0.85

B. Basis-of-Design Product: Subject to compliance with requirements, provide Cirrus Second Look III-514 or a comparable product by one of the following:

1. Hunter Douglas or USG.

C. Products: Subject to compliance with requirements, provide one of the following:
1. Certainteed Performance Series Gypsum Ceilings: Vinylrock X CRF or equal.
2. Composition: Vinyl face with gypsum core
3. Color: White
4. Size: 24 inches x 24 inches
6. Thickness: 1/2 inches
7. Edge Profile: Trim/ square
8. Ceiling Attenuation Class (CAC): 40
9. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.80

1.2 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.
b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and
ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16- inch- diameter bolts.

G. Hold-down clips: UHDC universal holddown clip by Armstrong.

H. Direct load ceiling clip: DLCC as manufactured by Armstong.

I. Column rings: Prefabricated clamp rings to support suspended ceilng by Fry Reglet.

1.3 METAL SUSPENSION SYSTEM FOR ACOUSTIC AL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; Prelude XL 15/16.

C. Basis-of-Design Product: Subject to compliance with requirements, provide [the previously noted product or a comparable product by one of the following:

1. Hunter Douglas or USG.

D. Suspension system for Vinyl faced gypsum core panels: 15/16 aluminum grid, 6063 T-5 aluminum alloy with white finish such as AL Prelude XL HD Environmental Tee System by Armstrong World Industries or equal.

1.4 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Model No. Prelude 15/16”

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member

C. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong “AXIOM Classic 4” high trim channel”, or a comparable product by one of the following:

D. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufa cturer's extruded- aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.
2. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

3. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating
0.010 mm or thicker) complying with AAMA 611.

1.5 ACOUSTIC AL SEAL ANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical
Sealant. c.

2. Acoustical Sealant for Concealed Joints:

a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
b. Pecora Corporation; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

C. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag,

paintable, nonstaining latex sealant[, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D EPA Method 24, complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636, UBC Standard 25-2 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer’s printed recommendations.

2. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

3. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

4. Support light fixture and other loads independently

5. Install reveal edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

6. Convene pre-installation conference minimum one (1) week prior to start of work. Contractor shall verify that all above-ceiling work is complete.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other cons truction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast -in- place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon con cealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

   a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of susp ension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire - resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 62 83

STRUCTURAL GLASS FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Recess walkable skylights.

B. Walkable skylights integrated with pedestal pavers.

C. Structural glass floors.

D. Structural glass stair treads and landings.

1.2 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Submit manufacturer's standard product data for each type of product.

C. Shop Drawings: Include fabrication and installation details.
   1. Include plans, elevations, sections, and details and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.

D. Samples for Verification: For each type of structural glass flooring and accessory, approximately 6 inches square and of same thickness and material indicated for the Work and showing the full range of normal color, pattern and texture variations expected.

E. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 2 years experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 years experience installing similar systems, and acceptable to the structural glass flooring manufacturer.

C. Delegated Design: Engineer glass flooring systems, including comprehensive engineering analysis by a qualified professional engineer licensed in the jurisdiction of the project.
   1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.

D. Source Limitations: Obtain each type of structural glass flooring panels and components from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

E. Physical Performance: Provide structural glass flooring, including anchorage, capable of withstanding, without defects, the effects of the following:
   1. Structural loads, including wind, snow, seismic or other anticipated loads.
   2. Thermal movements.
   3. Movements of supporting structure.
   4. Dimensional tolerances of building frame and other adjacent construction.

F. Performance: Provide structural glass flooring which does not exhibit any of the following defects after installation:
   1. Water leakage.
   2. Noise or vibration created by wind and thermal and structural movements.
   3. Framing members transferring stresses to glazing.
   4. Loosening or weakening of fasteners, attachments, and other components.
   5. Sealant failure.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle glass flooring systems as recommended by manufacture. Store off the ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Glass Flooring Systems, which is located at: 6 Aaron Way; Sparta, NJ 07871; Tel: 862-701-5320; Email: request info (wayne@glassflooringsystems.com); Web: glassflooringsystems.com

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 RECESSED WALKABLE SKYLIGHTS

A. Recessed Walkable Skylights: Provide fully glazed, fully assembled engineered SkyFloor walkable skylights by Glass Flooring Systems, Inc. with the following characteristics:
   1. Application: Interior.
   2. Type: SkyFloor Standard Unit Model SS - 5.0, dual light configuration.
   3. Frame Color: White.
   4. Frame Color: Black.
   5. Frame Color: Custom.
   6. Thermal Break: Required.
   7. Thermal Break: Not required.
   8. Glass: Standard float glass, textured walking surface.
   9. Aluminum Framing: Alloy 6063-T6 extruded aluminum.
   10. Clips and Fasteners: Stainless steel.
   11. Sealant: Dow Corning 995 structural sealant.
   12. Integrated Snap-On Setting Blocks: 80-90 shore hardness.
   13. Cap: Adjustable with backer rod strip.
   14. Lighting: Integrated LED lighting at perimeter.

2.3 STRUCTURAL GLASS FLOORING

A. Structural Glass Flooring: Provide engineered structural glass flooring by Glass Flooring Systems, Inc. with the following characteristics:

1. Application: Interior.
2. Application: Exterior.
3. Glass Assembly: Three layers of 3/8 inch glass with Eastman Safety PVB or SentryGlas® interlayers as applicable.
   a. Interlayer: Clear.
4. Slip-Resistant Floor Glass: Tested anti-slip textures.
   a. Finish: YorLux
5. Aluminum Framing: Alloy 6063-T6 extruded aluminum.
6. Clips and Fasteners: Stainless steel.
7. Sealant: Dow Corning 995 structural sealant.
8. Lighting: Integrated LED lighting at perimeter.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for existing conditions, installation tolerances, and other conditions affecting performance of structural glass flooring.
   1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
   2. Verify that pitch of 1/8 inch per foot is achievable.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install glass flooring in accordance with manufacturer's instructions and approved submittals and the following:
   1. Do not use panels with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
   2. Rigidly secure non-movement joints.
   3. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   4. Seal joints watertight.

B. Erection Tolerances: Install glass flooring systems to comply with the following maximum tolerances:
   1. Alignment: Limit offset from true alignment to 1/16 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
   2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet but no greater than 1/2 inch over total length.

3.3 CLEANING AND PROTECTION

A. Protect structural glass flooring from damage during construction until date of Substantial Completion. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Clean glass on both surfaces.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from during the construction period.

END OF SECTION

SECTION 096513

RESILIENT STAIR TREADS AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient stair accessories.
3. Resilient molding accessories.

B. Related Sections:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
2. Division 09 Section "Resilient Sheet Flooring" for resilient sheet floor coverings.
3. Division 09 Section "Linoleum Flooring" for linoleum floor coverings.
4. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.
5. Division 09 Section "Static-Control Resilient Flooring" for resilient floor coverings designed to control electrostatic discharge.
6. Division 09 Section "Resilient Athletic Flooring" for resilient floor coverings for use in athletic-activity
or support areas.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content and chemical components.

2. Materials and Resources (MR), Credit 4, Recycled Content: Manufacturer's or fabricator's certificate indicating percentage of postconsumer recycled content by weight and post-industrial recycled content by weight for each product specified under this section. Include statement indicating cost for each product having recycled content.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and

pattern required.

E. Product Schedule: For resilient products.[**At all interior Exit stairs and landings.**]

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Mockups: Provide resilient products with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than [**70 deg F (21 deg C)**] or more than [**95 deg F (35 deg C)**] , in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than [**55 deg F (13 deg C)**] or more than [**95 deg F (35 deg C)**] .

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than [**10 linear feet (3 linear m)**] for every [**500 linear feet (150 linear m)**] or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT STAIR ACCESSORIES

A. Resilient Stair Treads:

1. Manufacturers: Subject to compliance with requirements, [**provide products by one**

of the following]:

a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
b. Endura Rubber Flooring; Division of Burke Industries, Inc.
c. Estrie Products International; American Biltrite (Canada) Ltd.
d. Flexco, Inc.
e. Johnsonite.
f. Mondo Rubber International, Inc.
g. Musson, R. C. Rubber Co.
h. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
i. PRF USA, Inc.
j. R.C.A. Rubber Company (The).
k. Roppe Corporation, USA.
l. VPI, LLC; Floor Products Division.

B. Resilient Stair Treads Standard: ASTM F 2169.

1. Material Requirement: [**Type TS (rubber, vulcanized thermoset)**] .
2. Surface Design:
   a. Roppe rubber stair treads style #95 Hammered design with riser (F-19, F-24, F-25), complies with ASTM F 2169, Type TS, Class 2 (patterned).

3. Manufacturing Method: [**Group 1, tread with embedded abrasive strips**] .

C. Nosing Style: [**Square, adjustable to cover angles between 60 and 90 degrees**] .

D. Nosing Height: [**1-1/2 inches (38 mm)**] .

E. Thickness: [**1/4 inch (6 mm) and tapered to back edge**] .

F. Size: Lengths and depths to fit each stair tread in [**one piece**]

G. Risers: Smooth, flat, [**toeless, height and length to cover risers**]; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Thickness: [**0.125 inch (3.2 mm)**] [**0.080 inch (2.0 mm)**]

H. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

I. Colors and Patterns: [**As selected by Architect from full range of industry colors**].

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Rubber Floor Adhesives: Not more than 60 g/L.

C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

E. Floor Polish: Provide protective liquid floor polish products as recommended b y resilient stair tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMIN ATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatib le with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recomm ended by manufacturer[**and as follows**]. Proceed with installation only after substrates pass testing.

   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [**3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)**] in 24 hours.
   b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum [**75 percent**] > relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed

at le ast 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT ACCESSOR Y INSTALL ATION

A. Comply with manufacturer's written instructions for installing resilient access ories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of [**carpet**], concrete [**resilient floor covering**]and other, that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply [**three**] coat(s).

E. Cover resilient products until Substantial Completion.

3.5 INITIAL MAINTEN ANCE PROCEDURES

A. Include in contract sum cost for initial maintenance procedures and execution by p rofessional maintenance personnel after floor covering has been installed for three days as specified in the Roppe maintenance instructions.

END OF SECTION

SECTION 096519

RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 THIS SECTION INCLUDES

A. Resilient tile flooring as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work in this section only.

1.03 RELATED SECTIONS

A. Other Division 9 sections for floor finishes related to this section but not the work of this section.

B. Division 3 Concrete - not included work this section.

C. Division 6 Wood and Plastics - not included work this section.

D. Division 7 Thermal and Moisture Protection - not included work this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Qualifications of Installers: All work shall be done by installation firms specializing in commercial LVT installation. It is required, that the firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Certified Floorcovering Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in commercial installation of these materials and participation in manufacturer's environmental program including responsible carpet removal, recycling, and installation.

B. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive LVT.

C. Flooring contractor to provide owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after job completion.

D. All warranties must be issued by the manufacturer as standard published warranties on all types of LVT within this document. Second source warranties that involve parties other than the LVT manufacturer are unacceptable. If the product fails to perform as warranted when installed according to the EF Contract Flooring installation instructions and maintained according to EF Contract Flooring maintenance instructions, the affected area will be repaired or replaced at the expense of the manufacturer. The LVT manufacturer will provide standard published written performance warranties for the following:

1. A Ten (10) Year warranty on manufacturing defects and a Ten (10) year wear warranty stating that product will not wear through (damage or affect) the printed film layer due to normal traffic. Manufacturer will pay all reasonable labor costs (these costs will be determined by manufacturer).

E. LVT manufacturer to provide field service experts to assist in project start-up as required by the job. Manufacturer will notify owner, architect, general contractor, or another designated contact if any installation instructions are not followed.

F. Provide flooring material to meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the carpet manufacturer for each test method. Requirements listed below must be met by all products being submitted for approval:

1. Materials: Phthalates Free
2. Indoor Air Quality: FloorScore® Certified
3. LEED v4: Contributes to IAQ: Low Emitting Materials
4. End of Life: 100% Recyclable
5. Class / ASTM F1700: Class III Printed Film Vinyl Plank - Type B (embossed)
6. Flooring Radiant Panel: Class 1
7. ADA Compliance: Compliant For Accessible Routes
8. ASTM F2055 (Size and Tolerance): Passes
9. ASTM F386 (Thickness): Passes
10. ASTM F1914 (Residual Indentation): Passes
11. ASTM F137 (Flexibility): Passes
12. ASTM F2199 (Dimensional Stability): Passes
13. ASTM F925 (Chemical Resistance): Passes
14. ASTM F1514 (Resistance to Heat): Passes
15. ASTM F1515 (Resistance to Light): Passes
16. ASTM E648 (Critical Radiant Flux): Passes
17. ASTM E662 (Optical Smoke Density): Passes
18. ASTM C1028 (Slip Resistance): Passes
19. ASTM F970 (Static Load): Passes

1.05 SUBMITTALS

A. Submit to architect and/or owner ten (10) days prior to bid, two (2) finished samples of the exact type of LVT proposed, including quality, pattern, and color.

B. Submit manufacturer’s warranties, installation instructions, and maintenance instructions before bid date

C. Submit the manufacturer’s certification that the flooring has been tested by an independent laboratory and complies with the required fire tests as well as the test listed under 1.04 F.

D. Submit to architect and/or owner ten (10) days prior to bid, the manufacturers plan for recycling the specified flooring and related items at the end of the useful life of the flooring.

1.06 ENVIRONMENTAL/FIELD CONDITIONS

A. Deliver all materials to the installation site in the manufacturer’s original packaging and in good condition. Packaging to contain manufacturer’s name and marks, identification number, shipping and handling instructions and related information

B. Delivered and stored materials must be available for inspection as required by the owner, architect, general contractor, and/or the manufacturer.

C. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document. Sub-floor preparation shall meet all conditions as specified in EF Contract Flooring's Luxury Vinyl Tile installation instructions.

D. Sub-floor preparation will include, as required, the removal and repair of the existing floor surface. It is required that the floor of a renovation project be inspected before the bid date.

E. The building must be enclosed and the HVAC in continuous operation. The LVT and adhesive must be conditioned to room temperature for 3 days prior to installation, during the installation and continuous following completion of the installation. The ambient air relative humidity must be between 10%-65% with the floor and room temperature between 55- 85 degrees Fahrenheit. The indoor temperature should never fall below 55 degrees Fahrenheit or above 85 degrees Fahrenheit regardless of the age of the installation.

F. Store cartons of tile or plank products flat and squarely on top of one another. Preferably, locate material in the "center" of the installation area (i.e. away from vents, direct sun- light, etc.) Storing cartons in direct sunlight may affect proper acclimation by inducing thermal expansion/contraction.

G. When palletizing on a jobsite, vinyl plank or tiles need to be stacked 2 rows high side by side with no airspace between. Then quarter turned for 2 rows side by side, not to exceed 12 boxes high. A 5/8" or thicker plywood must also be placed on the pallet first. Do not stack pallets 2 high unless utilizing a 3/4" thick plywood cap between pallets.

1.07 SUBSTITUTIONS

A. All Bid submittals must conform to the specifications in this document.

B. All test results to be in accordance with a certified independent testing laboratory.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:

1. A ten (10) year warranty on manufacturing defects and a ten (10) year wear warranty stating that product will not wear through (damage or affect) the printed film layer due to normal traffic. If a verified material failure occurs, the manufacturer will pay 100% of all reasonable labor costs for the warranty period (these costs will be determined by manufacturer).
2. EF Contract Flooring, P.O. Box 1287, Dalton, GA, 30722. (800) 241-4586. WWW.EFCONTRACTFLOORING.COM. Please contact GEORGE MAIBACH, RVP, (714) 328-4154, george.maibach@efcontractflooring.com
3. Any manufacturer and/or product must meet or exceed those requirements specified under all sections of this document in pattern, color, and format. Any substitutions must be made in accordance with Section 1.00 of this document.

2.02 FLOORING MATERIALS

A. Luxury Vinyl Tile:

1. Product: Stained Concrete 2.5mm EFCSC
2. Color: Limestone 00002

3. Added Antimicrobial: Yes
4. Thickness: 2.5mm
5. Finish / Coating: UV Cured Urethane
6. Ceramic bead with immersion rate greater than 5 micrograms/sf
7. Pattern Repeat: Random Stone
8. Dimensions: 18" x 36"
9. Backing Class: Commercial Grade
10. Commercial Traffic: Heavy Commercial

2.03 ADHESIVES

A. Commercialon® Premium Modular/LVT Pressure Sensitive Adhesive, a premium modular flooring adhesive specifically formulated for bonding EF Contract Flooring's Luxury Vinyl Tile to the floor.

2.04 ACCESSORIES

A. Provide transition/reducing strips tapered to meet abutting materials as indicated in the drawings (if required).

B. Provide edge strips made of extruded aluminum with a mill finish, unless otherwise noted.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive flooring.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by carpet manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

F. EF Contract Flooring requires that the Luxury Vinyl Tile be inspected prior to installation for proper style, color and potential defects. No claims will be honored if the LVT is installed with visible defects. Should there be a problem, call EF Contract Customer Relations at 800.241.4586.

3.02 PREPARATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. SURFACE PREPARATION- Dust, dirt, debris and noncompatible adhesive must be removed before the installation begins. Surfaces must be smooth and level with all holes and cracks filled with Portland cement-based patch reinforced with polymers or primed with

Commercialon Premium Sealer.

C. LATEX OR OLD ADHESIVES - Must be mechanically scraped down to a bare residue flat with the concrete substrate or covered with a skim coat of Portland cement-based patch reinforced with polymers. Any old adhesive residue must also be covered with Commercialon Premium Sealer. Note: Failure to remove or seal old latex or cut back adhesive may cause installation failure, plasticizer migration, shifting, buckling or edge curling; these conditions will not be covered under warranty.
Note: Failure to remove or seal old latex adhesive may cause installation failure, shifting, buckling or edge curling; these conditions will not be covered under warranty.

D. CUT BACK ADHESIVES - Must be wet mechanically scraped to a minimum residue and encapsulated with Commercialon Premium Sealer.
Note: Failure to remove or seal old cut back adhesive may cause installation failure, shifting, buckling or edge curling; these conditions will not be covered under warranty.

E. CONCRETE MOISTURE TESTING and pH Testing - Substrate surfaces must be tested for moisture emission. It is the responsibility of the owner or owner's representative to perform moisture testing prior to starting the installation. ASTM-F2170-2 relative humidity probe moisture testing or ASTM-F1869 calcium chloride testing can be performed on the concrete to determine the surface moisture emission rate. Acceptable relative humidity probe testing results are up to 90% RH. An acceptable result for calcium chloride moisture testing is up to 5 lbs. per 1,000 SF per 24 hours. Alkalinity tests should also be performed per ASTM-F710. The maximum acceptable pH is 9.0. EF Contract Flooring prefers relative humidity probe moisture testing over calcium chloride testing, as the results are more accurate and reliable. For test results that determine RH test readings of 90% - 95%, moisture emission rates of 5 lbs - 8 lbs, or pH readings of 9.0 - 11.00, Commercialon Premium Sealer is required.

SUBFLOORS

F. New Concrete - New concrete must be fully cured and free of moisture. New concrete requires a curing period of approximately 90 days.

G. Old Concrete - Old concrete must be checked for moisture. Dry, dusty, porous floors must be primed; primers will not correct a moisture problem.

H. Wood - Wood floors must be smooth and level. If the floor is uneven, an approved underlayment will be required. Old finishes must be tested for compatibility with adhesives or removed and porous wood primed with Commercialon Premium Sealer.

I. Terrazzo / Marble - Level all grout lines with Portland cement-based patch reinforced with polymers. Glossy surfaces must be sanded for adhesive bond. Waxes and similar finishes must be removed.

J. Hard Surfaces - Tiles must be well secured to the floor or removed. Broken, damaged, or loose tiles must be replaced. Waxes and similar finishes must be removed from VCT before applying adhesive. Existing sheet vinyl is not a suitable substrate for LVT installation and must be removed.

K. Old Carpet - Remove old carpet and check adhesives for compatibility. If unsure, remove or cover adhesive with a Portland based patching compound or encapsulate with Commercialon Premium Sealer.

3.03 INSTALLATION OF FLOORING

1. Install EF Contract LVT using conventional tile and plank installation techniques. Plank products should have a minimum of 6-8” seam stagger.
2. Carefully determine where to begin tile or plank installation.
3. It is customary to center the rooms and hallways, so borders are not less than half a tile or plank.
4. Working out of multiple boxes at a time is recommended.
5. Make sure cut edges are always against the wall.
6. To properly cut LVT/LVP products score the top side of the material with a utility knife. Bend the product and finish the cut through the backside. This will ensure the cleanest cut. It may be necessary to use a heat gun to cut around vertical obstructions. Allow the heated LVT/LVP to return to room temperature before installation.
7. Cutting the product into a fine point may lead to delamination. Use an ethyl cyanoacrylate based super glue to help fuse the LVT/LVP point together. Be sure to clean all glue from the decorative surface immediately. Alcohol based super glues may cause the vinyl to swell.
8. Roll the plank/tile with a 3 section 100 lb. roller. Re-roll the entire glued floor area with the 100 lb. roller within the working time of the adhesive. Continue to roll the floor throughout the working day to ensure proper bond.

3.04 INSTALLATION OF ACCESSORIES

A. Install accessories as required by drawings and per manufacturer’s specifications.

3.05 CLEANING AND PROTECTION

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Recommended to use floor protection after installation. DO NOT use plastic adhesive based protection system.

3.06 FINISH SCHEDULE

A. Refer to drawings (Floor Finish Plan) and ROOM FINISH SCHEDULE for further details on location

LVT: Stained Concrete 2.5mm EFCSC in the Color: Limestone 00002 in RM 101, 103, 104, 110, 203, 204, 205 and 206A

END OF SECTION

SECTION 096813

MODULAR FLOORING FOR COMMERCIAL APPLICATIONS

PART 1 GENERAL

1.01 THIS SECTION INCLUDES

A. Textile composite flooring modules as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work in this section only.

1.03 RELATED SECTIONS

A. Other Division 9 sections for floor finishes related to this section but not the work of this section.

B. Division 3 Concrete - not included work this section.

C. Division 6 Wood and Plastics - not included work this section.

D. Division 7 Thermal and Moisture Protection - not included work this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Qualifications of flooring installation contractor: All work shall be done by installation firms specializing in commercial flooring and carpet installation. It is required, that the firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Certified Floorcovering Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in commercial installation of similar flooring materials and participation in manufacturer's environmental program including responsible flooring removal, recycling, and installation.

B. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive Kinetex modules. The installation standard will be as listed in EF Contract Kinetex Installation Instructions.

C. Flooring contractor to provide owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after job completion.

D. Manufacturer qualifications: Manufacturing facility to ISO 14001 certified and have a minimum of 20 years experience in the manufacture of commercial flooring.

E. Manufacturer to offer a reclamation program for the recycling of existing broadloom carpet, modular carpet tile and textile composite flooring.

F. All warranties must be issued by the manufacturer as standard published warranties on all types of flooring modules within this document. Second source warranties that involve parties other than the textile composite flooring manufacturer are unacceptable. If the product fails to

perform as warranted when installed according to the EF Contract's Kinetex installation instruction and maintained according to EF Contract's Kinetex maintenance instructions, the affected area will be repaired or replaced at the expense of the manufacturer. EF Contract will provide standard published written performance warranties for the following:

1. Lifetime product performance. Will not delaminate along seams or lose more than five (5%) percent by weight of fiber during its useful life.
2. Lifetime static propensity, meaning built-in protection below 3.0 kv as tested under AATCC-134.
3. Lifetime Stain Removal
4. Lifetime Colorfastness (Light and Crocking)

G. Manufacturer to provide field service experts to assist in project start-up as required by the job and will notify owner, architect, general contractor, or another designated contact if any installation instructions are not followed.

H. Provide flooring material to meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the manufacturer for each test method. Requirements listed below must be met by all products being submitted for approval:

1. Pill Test / DOC-FF-1-70 (ASTM D-2859) - Requirement: Pass
2. Flooring Radiant Panel / ASTM E-648 - Requirement: Class I (Above .45 w/cm)
3. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus™ Test.
4. Lightfastness: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC Test Method 16E.
5. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.
6. Atmospheric Fading: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC Test Method 129 Ozone and AATCC Test Method 23.
7. Noise Reduction Coefficient (ASTM C 423-02): NRC Rating of 0.30
8. Impact Insulation Classification (ASTM E 492-09): IIC Rating of 64
9. Slip Resistance (ASTM 1028-96): Complies with ADA Guidelines for level surface
10. Thermal Insulation (ASTM C 518): R-4

1.05 SUBMITTALS

A. Submit to architect and/or owner ten (10) days prior to bid, two (2) 6.5" x 6.5" (minimum size) finished samples of the exact type of flooring proposed, including quality, pattern, color and backing.

B. Submit to architect and/or owner ten (10) days before bid, any proposed substitutions for consideration. Submit at least three (3) references of installations using the same flooring technology, as described within this text. Include contact names and telephone numbers.

C. Submit manufacturer's warranties, installation instructions, and maintenance instructions before bid date.

D. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required flammability tests as well as other testing requirements as listed under 1.04 F.

1.06 ENVIRONMENTAL/FIELD CONDITIONS

A. Deliver all materials to the installation site in the manufacturer's original packaging and in good condition. Packaging to contain manufacturer's name and marks, identification number, shipping and handling instructions and related information.

B. Delivered and stored materials must be available for inspection as required by the owner, architect, general contractor and/or the manufacturer.

C. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document. Sub-floor preparation shall meet all conditions as specified in EF Contract's Kinetex textile composite flooring installation instructions.

D. Sub-floor preparation will include, as required, the removal and repair of the existing floor surface. It is required that the floor of a renovation project be inspected before the bid date.

E. All materials, including adhesives, are to be delivered to the site of installation at a minimum of 48 hours prior to the start of installation and stored in a clean and dry room that measures above 65°F and below 95°F and measures between 10% and 65% relative humidity (RH). To maintain temperature and relative humidity, permanent heating and air conditioning systems (HVAC) must be in operation. Place pallets of textile composite flooring modules on a flat surface (do not double stack pallets). After work is completed, the ambient room temperature should remain at 65°F and relative humidity between 10% and 65% for 48 hours. These materials and related adhesives shall be protected from the direct flow of heat from heating fixtures and appliances such as hot-air registers, radiators, or other. Site conditions shall include those specified in the flooring manufacturer's installation instructions and shall also include sufficient heat, light and power required for effective and efficient working condition.

F. Once the temperature and relative humidity in area for installation have been stabilized, loose lay the modules within the installation area and allow them to precondition for 48 hours prior to installation. Module installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved and completed. Traffic shall be closed during the installation of the textile composite flooring products. Verify concrete slabs are dry per the standards for bond and moisture tests listed in the manufacturer's installation instructions.

1.07 SUBSTITUTIONS

A. All Bid submittals must conform to the specifications in this document.

B. All test results to be in accordance with a certified independent testing laboratory.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Kinetex, a brand of EF Contract, 1502 Coronet Drive, Dalton, Georgia 30720. EFCONTRACTFLOORING.COM. Please contact GEORGE MAIBACH, RVP, (714) 328-4154, george.maibach@efcontractflooring.com

Any alternate manufacturer and/or product must meet or exceed those requirements specified under all sections of this document in pattern, color, and fiber. Any substitutions must be made in accordance with Section 1.00 of this document.

2.02 TEXTILE COMPOSITE FLOORING MATERIALS

A. Kinetex flooring modules (tiles):

1. Product: Dart KDAR
2. Color: Whiz DAR44
3. Backing: Kinetex Felt Cushion
4. Dye Method: Solution Dyed
5. Wear Layer: 100% Polyester
6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
7. Pattern Repeat: N/A
8. Soil Release: No
9. Standard Size: 24" x 24" (approx. (60.96cm x 60.96 cm)
10. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
11. Testing Specifications - Pill Test: Yes
12. Testing Specifications - Flooring Radiant Panel: Class 1
13. Testing Specifications - Smoke Density: Less than 450.0 flaming (ASTM E 662)
14. Testing Specifications - Static Test: Less than 3.0kv (AATCC-134)
15. Recycled content: Minimum of 47% recycled content
16. NSF/ANSI 140 Platinum Certified
17. Closed-loop recyclable

B. Kinetex flooring modules (tiles):

1. Product: Dart KDAR
2. Color: Surge DAR24
3. Backing: Kinetex Felt Cushion
4. Dye Method: Solution Dyed
5. Wear Layer: 100% Polyester
6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
7. Pattern Repeat: N/A
8. Soil Release: No
9. Standard Size: 24" x 24" (approx. (60.96cm x 60.96 cm)
10. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
11. Testing Specifications - Pill Test: Yes
12. Testing Specifications - Flooring Radiant Panel: Class 1
13. Testing Specifications - Smoke Density: Less than 450.0 flaming (ASTM E 662)
14. Testing Specifications - Static Test: Less than 3.0kv (AATCC-134)
15. Recycled content: Minimum of 47% recycled content
16. NSF/ANSI 140 Platinum Certified
17. Closed-loop recyclable

C. Kinetex flooring modules (tiles):

1. Product: Dual KDUL
2. Color: Growth DUL24
3. Backing: Kinetex Felt Cushion

4. Dye Method: Solution Dyed
5. Wear Layer: 100% Polyester
6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
7. Pattern Repeat: N/A
8. Soil Release: No
9. Standard Size: 24" x 24" (approx. (60.96cm x 60.96 cm)
10. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
11. Testing Specifications - Pill Test: Yes
12. Testing Specifications - Flooring Radiant Panel: Class 1
13. Testing Specifications - Smoke Density: Less than 450.0 flaming (ASTM E 662)
14. Testing Specifications - Static Test: Less than 3.0kv (AATCC-134)
15. Recycled content: Minimum of 47% recycled content
16. NSF/ANSI 140 Platinum Certified
17. Closed-loop recyclable

D. Kinetex flooring modules (tiles):

1. Product: Chinook KCNK
2. Color: Fresh Air CNK44
3. Backing: Kinetex Felt Cushion
4. Dye Method: Solution Dyed
5. Wear Layer: 100% Polyester
6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
7. Pattern Repeat: N/A
8. Soil Release: Yes
9. Standard Size: 24" x 24" (approx. (60.96cm x 60.96 cm)
10. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
11. Testing Specifications - Pill Test: Yes
12. Testing Specifications - Flooring Radiant Panel: Class 1
13. Testing Specifications - Smoke Density: Less than 450.0 flaming (ASTM E 662)
14. Testing Specifications - Static Test: Less than 3.0kv (AATCC-134)
15. Recycled content: Minimum of 47% recycled content
16. NSF/ANSI 140 Platinum Certified
17. Closed-loop recyclable

E. Kinetex flooring modules (tiles):

1. Product: Chinook KCNK
2. Color: Windgust CNK59
3. Backing: Kinetex Felt Cushion
4. Dye Method: Solution Dyed
5. Wear Layer: 100% Polyester
6. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot
7. Pattern Repeat: N/A
8. Soil Release: Yes

9. Standard Size: 24" x 24" (approx. (60.96cm x 60.96 cm)
10. Warranties: Lifetime Product Performance, Colorfastness to Light & Crocking, Stain Removal, Static Protection, Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
11. Testing Specifications - Pill Test: Yes
12. Testing Specifications - Flooring Radiant Panel: Class 1
13. Testing Specifications - Smoke Density: Less than 450.0 flaming (ASTM E 662)
14. Testing Specifications - Static Test: Less than 3.0kv (AATCC-134)
15. Recycled content: Minimum of 47% recycled content
16. NSF/ANSI 140 Platinum Certified
17. Closed-loop recyclable

2.03 ADHESIVES

A. Kinetex® Adhesive, an aggressive, pressure-sensitive adhesive designed for the installation of Kinetex textile composite flooring modules is required.

B. Kinetex PreFix®, a quick installation for all Kinetex textile composite flooring products. The release liner easily peels away to reveal a series of pre-applied adhesive strips that securely anchor the Kinetex module in place, (PreFix Primer is required).

2.04 ACCESSORIES

A. Kinetex requires protective transition 3/16-inch to other floor covering thickness. Provide transition/reducing strips tapered to meet abutting materials as indicated in the drawings.

B. Provide aluminum edge with lip to protect Kinetex edge.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive installation of modules.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive installation of modules.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by EF Contract.

E. Verify that required floor-mounted utilities are in correct location.

F. EF Contract requires that Kinetex textile composite flooring be inspected prior to installation for proper style, color and potential defects. No claims will be honored if the modules are installed with visible defects. Should there be a problem, call EF Contract's Customer Relations Department at 800.241.4586.

3.02 PREPARATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. SURFACE PREPARATION- Dust, dirt, debris and non-compatible adhesive must be removed before the installation begins. Surfaces must be smooth and level with all holes and cracks filled with Portland cement-based patch reinforced with polymers. Kinetex Adhesive cannot be applied to any substrate where chemical or solvent-based cleaners have been used.

C. LATEX ADHESIVES - Old latex adhesives must be mechanically scraped down to a bare residue. Latex adhesive residues must be smooth and level with all holes and cracks filled with a Portland cement-based patch reinforced with polymers, or encapsulated with APAC ENCapSeal. Note: Failure to remove or seal, old latex adhesive may cause installation failure, shifting, buckling or edge curling; these conditions will not be covered under warranty.

D. CUT BACK ADHESIVES - Must be wet mechanically scraped to a minimum residue and encapsulated with APAC ENCapSeal.
Note: Failure to remove or seal old cut back adhesive may cause installation failure, shifting, buckling or edge curling; these conditions will not be covered under warranty.

E. CONCRETE MOISTURE TESTING and pH TESTING - Substrate surfaces must be tested for moisture emission. It is the responsibility of the owner or owner's representative to perform moisture testing prior to starting the installation. ASTM-F 2170-2 relative humidity probe moisture testing is required. Acceptable relative humidity probe testing results are up to 100% RH when using Kinetex Adhesive or Kinetex PreFix. Alkalinity tests should also be performed per ASTM F 710. The maximum acceptable pH is 11.0 when using Kinetex Adhesive or Kinetex PreFix.
Note: pH readings of 9.0 - 11.00, Commercialon Premium Sealer is required.

SUBFLOORS

F. New Concrete - New concrete must be fully cured and free of moisture (see ASTM F 710). New concrete requires a curing period of approximately 90 days.

G. Old Concrete - Old concrete must be checked for moisture. Dry, dusty, porous floors must be primed. Note: Primers will not correct a moisture problem. For complete information, refer to CRI-104 Installation Standard.

H. Wood - Wood floors must be APA flooring grade smooth and level, or CanPly Select Grade. If the floor is uneven, an approved underlayment will be required. Old finishes must be tested for compatibility with adhesives or removed and porous wood primed. Wood floors must receive a roll-on application of Commercialon® Premium Sealer. Follow instructions on the Commercialon® Premium Sealer label.

I. Terrazzo / Marble - Level all grout lines with Portland cement-based patch reinforced with polymers. Glossy surfaces must be sanded for proper adhesive bond. Waxes and similar finishes must be removed.

J. Other Hard Surfaces (VCT/VAT) - Tiles must be well secured to the floor or removed. Broken, damaged or loose tiles must be replaced. Waxes and similar finishes must be removed from VCT before applying adhesive. Existing sheet vinyl is not a suitable substrate for modular installation and must be removed.

K. Raised Access Panel Floors -The panels must be flat, warped panels can result in the carpet modules being off grid. The panel joints must be tight and level. Screws are to be countersunk.

L. Gypcrete - Gypcrete subfloors must be fully cured and free of high moisture (see ASTM F

2170-2). Gypcrete requires a curing period of approximately 90 days. Additionally, Gypcrete must be treated using primer in advance of applying adhesive.

M. Carpet - Remove old carpet and carpet adhesives by scraping or other mechanical means. Any remaining adhesive residues may be covered with a Portland based patching compound or encapsulated with TriSeal Sealer.

3.03 INSTALLATION OF TEXTILE COMPOSITE FLOORING

A. Install flooring in strict accordance with the finish drawings and EF Contract's Kinetex installation instructions.

B. ADHESIVE SYSTEM - Kinetex requires use of Kinetex Adhesive or PreFix pre-applied adhesive for all Kinetex flooring modules.
Full Spread Kinetex Adhesive System: Installation requires full spread use of Kinetex Adhesive. The spread rate for Kinetex Adhesive is approximately 640 square feet per four- gallon bucket over a properly prepared floor and must be spread using a 1/16” x 1/16” x 1/16” square notched trowel. Kinetex adhesive is a transitional hard-set PSA with limited working time. Allow the adhesive to dry until the anchor lines are visible and begin installation. Once the control lines are visible complete theinstallation within 2 hours, which includes trimming and rolling. Replace the trowel clip each time that a new 4-gallon pail of Kinetex Adhesive is opened. Kinetex adhesive average coverage is 640 SF per 4 gallon pail or 160 SF per one gallon pail.

Note: Inadequate amounts of adhesive can cause modules to shift and move and will not be covered by warranty. EF Contract will not be responsible for the adhesive bond where other adhesives have been used.
PreFix Pre-Applied Adhesive
PreFix Primer Application (REQUIRED) Note: Read all installation instructions thoroughly.
Pour the diluted primer onto the substrate and roll on using 3/8" nap or foam roller. Do not puddle. Additional coats may be required upon visual inspection over extremely porous concrete. Allow the material to dry to the touch. Lower substrate temperatures and/ or higher humid conditions could extend the drying time
Installing PreFix Kinetex Modules
After the PreFix primer has dried, begin the installation at the intersection of the central module anchor lines. Peel off the release film and save it to be recycled. Complete the installation one quarter area at a time laying the modules firmly and accurately along the anchor lines. Follow approved installation method(s) for each specific product.

C. MODULE PLACEMENT - Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slid-in modules, but instead lay each module into its location against the adjoining module. Use your hands to press/form the module into place where the new module meets the previously installed module. See specific product specifications for approved installation method(s).

Note: To reposition a Kinetex module during installation, remove it by gently lifting all four sides of the module with a spatula or putty knife, rotating around each side of the module doing a little at a time. The very center of the module should be the last part of the module touching the floor upon removal. Do not stretch a module while it is in the adhesive in order to align next to an adjoin modular. An attempt to stretch will likely result in the module pulling back to its original position. NEVER ATTEMPT TO REMOVE A MODULE ALL AT ONCE BY PULLING ONE OR ONLY TWO SIDES OF THE MODULAR. DOING SO MAY LEAD TO DISTORTING THE MODULE.

D. PALLET AND BUNDLE SEQUENCING - It is very important to install Kinetex modules in

the order they were manufactured; this is easily accomplished by selecting pallets in sequential order and following the numbers located on each bundle of modules. Typically, an installation will begin with the lowest bundle numbers and progress through the highest numbers until the project is complete. Installing modules by bundle sequence will assure the most even uniform look possible. (For layout and installation instructions refer to EF Contract's Kinetex Installation Instructions.)

E. STAIRS - Use single or double undercut stair nosing and cut modules. Then, using full spread Kinetex Adhesive or SRT Tape, install modules on steps and risers, inserting the stair nosing edge and the top of the riser edge of each module into the vinyl undercut.

F. COMPLETING INSTALLATION - To avoid dislodging modules, do not walk on or move furniture onto modules until the area is completely anchored. Roll entire area with 75-100 lb. roller in both directions (north-south and east-west) after completion of installation. It is also required that sheets of plywood or hardboard be laid over the new modular surface when transporting heavy furniture on carts or dollies. As a final step, vacuum the entire area with an upright vacuum.

3.04 INSTALLATION OF ACCESSORIES

A. Install accessories as required by drawings and per manufacturer's specifications.

3.05 CLEANING AND PROTECTION

A. Use a moist cloth when wet; if dry, use a solvent based product applied to a towel then worked onto the Kinetex module for removal of contaminants such as adhesive, paint, oil and grease. Follow EF Contract's maintenance guidelines.

B. Clean and vacuum surfaces.

3.06 FINISH SCHEDULE

A. Refer to drawings (floor finish plan) and room finish schedule for further details on location.
B. Some colors will be intermixed within one space.

BASIS OF DESIGN

TC-1: DAR44 “WHIZ”, in RM 206 AND 223 (ACCENT COLOR, PATTERN AS SELECTED BY ARCHITECT)
TC-2: DAR24 “SURGE”, in RM 208C AND 208D (ACCENT COLOR, PATTERN AS SELECTED BY ARCHITECT)
TC-3: DUL24 “GROWTH” in RM 208C, 208D, 212 and 225
TC-4: CNK44 “FRESH AIR” in RM 206, 207 and 232
TC-5: CNK59 “WINDGUST” IN ALL OFFICE AREAS; RM 200, 201, 210, 211, 213,218 219, 220, 221, 223, 226, 227, 228, 229, 230, 231

SECTION 097216 – VINYL WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Vinyl wall covering.
2. Woven glass-fiber wall covering.
3. Textile wall covering.
4. Heavy-duty synthetic textile wall covering.
5. Wallpaper.
6. Wood-veneer wall coverings.
7. Graphic digital wallcoverings

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
2. Division 09 Section "[**Interior Painting**]" for primers, coatings, and paint for woven glass-fiber wall coverings.
3. Division 09 Section "[**Interior Painting**]" for priming wall surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate [**pattern placement,**] seams and termination points.

C. Samples for Initial Selection: For each type of wall covering indicated.

D. Samples for Verification: Full width by 36-inch- (1000-mm-) long section of wall covering from lot to be used for each type of wall covering indicated for each color, texture, and pattern required.

1. With specified [**treatments**] [**paint**] applied.
2. Show complete pattern repeat.
3. Mark top and face of material.

E. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for adhesives, including printed statement of VOC content.
2. Credit EQ 4.2: For field-finished wood-veneer wall coverings, submit manufacturers' product data
for transparent finishes, including printed statement of VOC content and chemical

components.

3. Credit MR 7: Certificates of chain-of-custody signed by manufacturers certifying that wood-veneer wall coverings were made from wood obtained from forests certified by an FSC-accreditedcertification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.

F. Schedule: For wall coverings. Use same designations indicated on Drawings.

G. Maintenance Data: For wall coverings to be included in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide wall coverings and adhesives with the following fire-test-response characteristics as determined by testing identical products applied with identical adhesives to substrates per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

Surface-Burning Characteristics: as follows:

1. Per ASTM E 84: Flame-Spread Index: [**25**] or less.
2. Smoke-Developed Index: [**140**] or less.

3. ASTM G21: Passed Mold & Mildew Resistance Requirements.

4. Fire-Growth Contribution: Textile wall coverings complying with acceptance criteria of UBC Standard 8-2.
5. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 265 and complying with Method A test protocol in IBC 2000, Section 803.5.1.

B. Forest Certification: Provide wood-veneer wall coverings produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.

1. Provide a mockup for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install wall coverings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Wood-Veneer Wall Coverings: Condition spaces for not less than 48 hours before installation.

B. Lighting: Do not install wall covering until [**a permanent level of lighting]** is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Material: Full-size units equal to [**5**] percent of the amount of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in Part 2 "Wall-Covering Products" Article.

B. Products: Subject to compliance with requirements, provide one of the products listed in Part 2 "Wall- Covering Products" Article.

2.2 WALL-COVERING PRODUCTS

A. General: Provide rolls of each type of wall covering from the same run number or dye lot.

B. Vinyl Wall Covering selections, See section 3.6 for Locations

C. Products:

A. Vinyl Wallcovering:

1. **Category:** V, Type II 20 oz. PVC-Vinyl Wallcovering (Microfiber)
2. **Composition:** Woven-backed textured vinyl printed with UV-LED inks
3. **Roll Width:** 52/54” (132/137 cm)
4. **Weight:** 20 oz. per lineal yard (13.3 oz. per sq. yd.)
5. **Backing:** Osnaburg
6. **Installation:** Random Match
7. **Fire Ratings:** ASTM E-84 Class “A”, Passes Class A NFPA 101 Life Safety Code, and Passes NFPA 286 Corner Burn Test
8. **Packaging:** : 30-yard bolts (available in 15-yard increments, with a possible cutting charge for 15-yard orders)
9. **Environmental & Safety Standards:** UV-LED, nearly zero VOCs, UL GREENGUARD Gold Certified. Wallcoverings contain anti-microbial additives to aid in resisting the growth of mildew and bacteria including staphylococcus aureus, streptoverticillum and mixed fungal spore such as aspergillum niger, chaetomium globosum and penicillium funiculosum.

    - CE Declaration of Conformity

- Meets GSA Federal Specification CCC-W-408 A-B-C-D
- Complies with CCC-T-191A testing standards
- Approved for use in the City of New York (MEA 48690 Department of Buildings)
- Manufactured using environmentally safe, non-toxic print materials
- Free from heavy metals (mercury, cadmium, chromium)
- Contains antimicrobial additives to resist mildew and bacteria
- Anti-microbial Top Coat Available

10. **Specification Data:** Complies with Federal Specification CCC-T-191A testing standards
11. **Color and Pattern:** National Solutions: Command Wallcovering, pattern CM119-2414 Microfiber in the color “Terracotta”

B. Vinyl Wallcovering:

1. **Category:** Vinyl Wallcovering (Pashmina)
2. **Composition:** Type III 28 oz (*Type II 20 oz for specific models
3. **Roll Width:** 52/54”
4. **Weight:** Type III 28 oz (*Type II 20 oz for specific models)
5. **Backing:** Osnaburg
6. **Installation:** Random Match
7. **Fire Ratings:** Class A, ASTM E84, Europe CE Fire Tested
8. **Environmental & Safety Standards:**
    - Low emitting—passes Cal 01350 Standard (LEED EQ 4.2)
    - NSF 342
    - Contains up to 40% recycled content
    - Free of conflict minerals, heavy metals, solvents, and certain phthalates
    - PFC/PFOA-free
    - Printed with solvent-free inks
    - CE Declaration of Conformity
9. **Specification Data:** Meets Federal Specifications CCC-W-408D for scrubbability, washability, and stain resistance
10. **Color and Pattern:** National Solutions: Command Wallcovering, pattern CM161-2952 Pashmina in the color “Light Taupe”

C. Vinyl Wallcovering:

1. **Category:** Type II Wallcovering (Canyon Clay)
2. **Composition:** 10% Recycled Content, Non-Phthalate
3. **Roll Width:** 54” / 137 cm
4. **Weight:** Type II 20 oz. PLY, 620 G/ PLM 13.3 13.3 oz. PSY, 452 G /PSM
5. **Backing:** Osnaburg
6. **Fire Ratings:** Meets or exceeds Federal Specification CCC-W-408D for Type II Wallcovering
7. **Environmental & Safety Standards:**
    - Low VOC, California section 01350 IAQ
    - 10% Recycled Content
    - Non-Phthalate
    - EPD/HPD

8. **Specification Data:**
    - Inherent anti-microbial protection
    - Withstands hospital-grade cleaners & disinfectants
    - Available with INVISICAP | complete chemical protection
    - Warranty: 5-year warranty against manufacturing defects
9. **Color and Pattern:** National Solutions: VYCON Wallcovering, pattern Y48246CC Canyon Clay in the color “Sandstone”

D. Vinyl Wallcovering:

10. **Category:** Vinyl Wallcovering (Brocha™ Type II)
11. **Composition:** Nonwoven Fabric
12. **Roll Width:** 52/54” (132/137 cm)
13. **Weight:** 20 oz./LY (619 G/PLM), 13.3 oz./SQ (451 G/PSM)
14. **Backing:** NonWoven
15. **Fire Ratings:** ASTM E-84 Tunnel Test (Class A, Flame Spread: 10; Smoke Developed: 10); Passes NFPA 286 Corner Burn Test
16. **Environmental & Safety Standards:**
    - Meets Federal Specification CCC-W-408A-D, W-101
    - Compliant with EN 15102 (European Standard for Decorative Wallcoverings)
    - Phthalate-free, no heavy metals or formaldehyde
    - Printed with low VOC inks
    - Ultra-low emitting (Pass rating under CA 01350)
    - Contains anti-microbial additives (ASTM G-21)
17. **Specification Data:**
    - Federal Specification Compliance
    - Moisture and Mold Resistance (not recommended for high-condensation areas)
    - Five-year warranty against material defects
18. **Color and Pattern:** National Solutions: Colour&Design Wallcovering, pattern Brocha in the colors CD2-BRO-01 “Neblina”, CD2-BRO-06 “Mar Azul” and CD2-BRO-14 “Tierra Roja”

E. Graphic Digital Wallcovering:

19. **Category:** Mural Design - Digital Wallcovering (Circuit Board) - Upbeat
20. **Composition:** White Vinyl Stipple
21. **Material:** Type II 20 oz. Textured White Vinyl Wallcovering
22. **Coating:** Coated w/ WallMax Liquid Laminate
23. **Roll Width:** INFINITE, Per room wall dimensions.
24. **Specification Data:** For further information Contact National Solutions or Level
25. **Color and Pattern:** National Solutions: Level Digital Wallcovering, Design #L60303 Circuit Board in the style Upbeat.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining [**strippable**] adhesive compliant with VOC requirements, for use with specific wall covering and substrate application, as recommended in writing by wall-covering manufacturer **[and with a VOC content of 50 g/L or less when calculated according**

to 40 CFR 59, Subpart D (EPA Method 24)].

B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section **"[InteriorPainting]"** and recommended in writing by wall-covering manufacturer for intended substrate.

C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall -covering manufacturer.

D. Seam Tape: As recommended in writing by wall-covering manufacturer.

E. Metal Primer: Interior ferrous metal primer complying with Division 09 Section [**InteriorPainting**]

PART 3 - EXECUTION

3.1 EXAMIN ATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, dirt, and dust.

C. Use only a lead pencil for marking walls and back of wallcovering. Do not use ballpoint or marking pen, they will bleed through the surface.

D. Do not install wallcovering unless a temperature between 70º F and 100º F, with a relative humidity level of 50% or less is maintained in both areas of installation and storage for at least 72 hours prior to, during, and after installation.

E. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity.
3. Metals: If not factory primed, clean and apply metal primer.
4. Gypsum Board: Prime with primer recommended by wall-covering manufacturer.
5. Painted Surfaces: Treat areas susceptible to pigment bleeding.

F. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

G. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

H. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

I. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

J. Make sure that all surfaces to receive wallcovering are protected from damage during installation.

3.3 INSTALL ATION

NOTE TO INSTALLER BEFORE YOU BEGIN

- Confirm that this is the correct product for this installation.
- Assess all walls for significant bowing or other uneven surfaces that may cause misalignment of panels.
- Inspect the product as you install each drop, looking for any apparent defects.

If no defect is evident before installation, the material should be inspected after three (3) panels are installed. Should you discover any problems at this time (or at any point during installation), STOP IMMEDIATELY and CONTACT LEVEL at (216) 432-1400 X.108. LEVEL WILL NOT BE RESPONSIBLE FOR CHARGES OVER THREE (3) PANELS OF MATERIAL.

A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

D. Install reversing every other strip.

E. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

F. Match pattern 72 inches (1830 mm) above the finish floor. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and [**3 inches (75 mm)**] [**6 inches (150 mm)**] from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.

G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

H. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 FIELD FINISHING OF WOOD-VENEER WALL COVERINGS

A. Apply stain and urethane according to manufacturer's written instructions to produce finish that is consistent in color and gloss and matches approved Samples.

B. Apply not less than [**two**] [**three**] finish coats.

3.5 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

3.6 **Room Finish Schedule**

A. Refer to Room Finish schedule for further detail on Wall Covering location.
Basis of Design:

WC-1: National Solutions, Microfiber - CM119-2414 “Terracotta”
WC-2: National Solutions, Pashmina - CM161-2952 “Light Taupe”
WC-3: National Solutions, Canyon Clay - Y8246CC “Sandstone”
WC-4: Colour&Design, Brocha - CD2-BRO-1 “Neblina”
WC-5: Colour&Design, Brocha - CD2-BRO06 “Mar Azul”
WC-6: Colour&Design, Brocha - CD2-BRO-14 “Tierra Roja”
DW: National Solutions: Level Digital Wallcovering, Design #L60303 Circuit Board in the style Upbeat.

END OF SECTION

SECTION 09 77 00

DRY ERASE WALL COVERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Dry erase wall covering.

B. Related Sections:
1. Section 09 21 16 - Gypsum Board Assemblies: taping and bedding of gypsum board.
2. Section 10 11 16 - Markerboards and Tackboards.

1.2 SUBMITTALS

A. Samples: Submit in accordance with Section 01 33 23 - Shop Drawings, Product Data, and Samples. Submit 6" square samples of each type of dry erase wall covering.

B. Certificate: The manufacturer of the proposed dry erase wall covering shall furnish to the Architect written certification that the material shipped to the project will meet the physical and performance requirements listed below. Certification from a dealer or distributor will not be acceptable.

C. Maintenance Instructions: Submit copies of the dry erase wall covering manufacturer's printed instructions for maintenance of the installed work.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Work shall be performed by a skilled applicator having at least three years' experience in the installation of dry erase wall covering.

B. Source Quality Control: Flame spread rating of the material shall be determined by ASTM E 84. Each roll of goods delivered to the project shall bear Underwriters' Laboratories labels.

C. Composition: Self-adhesive backing, pigmented vinyl color shall be white capped with dry erase low gloss film.

D. Surface Burning Characteristics Classification: Provide materials that meet Class I/A rating when tested in accordance with ASTM E84 for flame spread and smoke developed.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver wallcoverings to the project site in unbroken and undamaged original factory packaging and clearly labeled with the manufacturer's identification label, quality or grade, and lot number.

B. Store materials in a clean, dry storage area with temperature maintained above 55°F. with normal humidity.

C. Store material within original packaging to prevent damage.

1.5 PROJECT CONDITIONS

A. Do not apply wallcoverings when surface and ambient temperatures are outside the temperature ranges required by the wallcovering manufacturer.

B. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 55°F. unless required otherwise by manufacturer's instructions.

C. Apply adhesive when substrate surface temperature and ambient temperature is above 55°F. and relative humidity is below forty percent.

D. Maintain constant recommended temperature and humidity for at least seventy-two hours prior to and throughout the installation period, and for seventy-two hours after wallcovering installation completion.

E. Provide not less than 80-foot-candles per square foot lighting level measured mid-height at substrate surfaces.

1.6 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver to project site not less than 6 linear yards of each type, color, and pattern of dry erase wall covering installed. Furnish maintenance materials from same production run as materials installed. Other remnants, usable scraps, and overage in wall covering shall be packaged in appropriate wrapping, labeled, and delivered to the Owner.

1.7 WARRANTY

A. Submit manufacturer's limited five-year written warranty against manufacturing defects.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Dry Erase Wall Covering (Markerwall): Provide Walltalkers mag●rite II: M248: Magnetic receptive, moderate gloss vinyl surface for dry erase markers, 47/48 inch width, and woven backing as manufactured by Koroseal Interior Products, Fairlawn, Ohio or approved equivalent. Color shall be standard white.

B. Aluminum Tray: Clear satin, anodized aluminum, snap-on magnetic marker and eraser tray with aluminum end caps.

C. Adhesives: Koroseal A-848-B, or heavy-duty clear or clay based premixed vinyl adhesive recommended by wall covering manufacturer.

D. Substrate Primer/Sealer: White pigmented acrylic base primer/sealer specifically formulated for use with vinyl wallcoverings

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrates and installation conditions to ensure surface conditions meet a Level 5 finish, per GA- 214-M-97: Recommended Levels of Gypsum Board Finish, and permanent lighting should be installed and operational.

B. Test substrate with a suitable moisture meter and verify that moisture content does not exceed four percent.

C. Verify substrate surface is clean, dry, smooth, structurally sound, and free from surface defects and imperfections that would show through the finished surface.

D. Evaluate all painted surfaces for the possibility of pigment bleed-through.

E. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.

F. Beginning of installation means acceptance of surface conditions.

3.2 PREPARATION

A. Clean surfaces to receive dry erase wall covering, including dirt, grease, oil, other contaminants. Surfaces shall be dry, smooth, and clean. Protrusions or low spots must be sanded or filled, as needed, to achieve a smooth surface.

B. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

C. Remove electrical plates and covers, light fixture trims, and similar items.

3.3 INSTALLATION

A. Applying Wall Covering: Follow the manufacturer's printed instructions for cutting and installing dry erase wall covering.
   1. Acclimate wallcovering in the area of installation a minimum of twenty-four hours before installation.
   2. Read and follow the manufacturer's installation instruction sheet contained in each roll of the dry erase wallcovering.
   3. Examine all materials for pattern, color, quantity and quality, as specified for the correct location prior to cutting.
   4. Primer: Use a quality pigmented acrylic wallcovering primer.
   5. Adhesive: Apply a uniform coat of heavy-duty pre-mixed clay-based or extra strength clear wallcovering adhesive recommended for fabric backed vinyl wallcovering and approved by manufacturer.
   6. Install each strip horizontally and in the same sequence as cut from the roll.
   7. Install dry erase wallcovering sheets in exact order as they are cut from bolt. Reverse hang alternate strips (except lined products). Do not crease or bend the wallcovering when handling.
   8. Install dry erase wallcovering horizontally using a level line.
   9. Using a level or straight edge, double cut the seam with a seam-cutting tool (Ex: Double Seam-Cutter or Swedish Knife). Do not score drywall or plasterboard when cutting material.
   10. When covering the entire wall, seam the material out of the main writing and viewing areas of the wall.
   11. Apply wallcovering to the substrate using a wallcovering smoother, wrapped with a soft cloth, to remove air bubbles. Do not use sharp edged smoothing tools. Smooth material on the wall from the middle to the outside edge.
   12. Remove excess adhesive immediately after the wallcovering is applied. Clean entire surface with a warm mild soap solution, and clean soft cloths. Rinse thoroughly with water and let dry before using. Change water often to maintain water clarity.
   13. Stop installation of material that is questionable in appearance and notify the manufacturer's representative for an inspection.

3.4 CLEANING

A. Clean dry erase wall covering with mild soap powder dissolved in warm water, and remove excess adhesive at joints and on adjacent surfaces.

B. Replace dry erase wall covering that cannot be successfully cleaned or that is applied to defective substrate surfaces.

C. Reinstall electrical plates and covers, light fixture trims, and similar items.

D. Upon completion of the work, remove surplus materials, rubbish, and debris resulting from the wallcovering installation. Leave areas in neat, clean, and orderly condition.

END OF SECTION

ACOUSTICAL SYSTEMS WALL PANEL SYSTEM

SECTION 09 80 00

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. This section includes Acoustic Metal Wall Panels as shown on the Architectural Drawings.
B. Related sections include the following:

1. Section 09 22 16 – Non-Structural Metal Framing
2. Section 09 29 00 – Gypsum Board

1.02 RELATED DOCUMENTS/SECTIONS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions.
B. Division 1 Specification sections apply to work of this Section.
C. Finish Schedule or Finish Legend applies to work of this Section.

1.03 REFERENCES:

A. GENERAL
   1. Comply with applicable requirements of the following, except where more stringent requirements are indicated by building codes.
B. ASTM (American Society for Testing and Materials)
   1. ASTM C634: Definition of Terms Relative to Environmental Acoustics.

1.04 DESIGN/PERFORMANCE REQUIREMENTS:

A. All components of the Acoustical Wall Panel System shall be provided by one (1) Manufacturer to ensure single source responsibility and quality control.

1.05 SUBMITTALS:

A. Submission must be made within ten (10) working days of the General Contract Award to avoid project delay.
B. Product Data: Submit Manufacturer's technical data and brochures for specified system.
C. Shop Drawings: Submit Shop Drawings for fabrication and installation of Acoustical Wall Panel System including the following:
   1. Location of Acoustical Wall Panel System
   2. Panel metal type and thickness
   3. Panel corrugation pattern
   4. Perforated or non-perforated
   5. Dimensions
   6. Sizes
   7. Finishes
D. Samples:
   1. Submit three (3) samples consisting of 12'' long Z Furring and J Trim along with 12'' x 12'' corrugated Panel.
E. Product Test Reports:
   1. All products furnished shall have a flame spread classification of 0-25 for a Class A or Class 1 rating in accordance with ASTM E84.

2. All products furnished shall be tested in accordance with ASTM C-423 for Sound Absorption. Test results for a Type A mounting method shall yield an NRC (Noise Reduction Coefficient) of no less than 0.9. Test results for a Type D-100 mounting method shall yield an NRC (Noise Reduction Coefficient) of no less than 0.9.

F. Closeout Submittals
   1. Provide Manufacturer's Cleaning and Maintenance Instructions
   2. Warranty Documents

1.06 QUALITY ASSURANCE:

A. Manufacturers' Qualifications: Firm with manufacturing and delivery capacity required for the project, shall have successfully completed at least ten (10) projects within the past five (5) years, utilizing systems, materials, and techniques as herein specified.
B. Fabricator must own and operate its own manufacturing facilities for all metal components. Systems consisting of components from a variety of Manufacturers will not be considered or accepted.
C. Manufacturer/Fabricator must own and operate its own painting and finishing facility to assure single source responsibility and quality control.
D. Installer's Qualifications: Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to the Manufacturer of the System.
E. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct testing indicated, as documented according to ASTM E 548.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver Panels and all system hardware to the job site in Manufacturer's original packaging, unopened and undamaged, just prior to installation.
B. Avoid warpage and damage by storing Panels and all system hardware above floor, flat and in a dry, humidity and temperature controlled interior location.
C. Follow Manufacturer's instructions and exercise care during off loading, handling and installation to avoid damage and marring of finishes.

1.08 SEQUENCING:

A. Substitute Products: Alternate proposals for substitute products will not be accepted unless approval is issued in addenda.
B. Contract Execution: Submittals shall be completed and approved prior to award of subcontract for system components.
C. Manufacturer's Production Schedule: Subcontract for the work of this section shall be planned to allow sufficient time for Manufacturer's production and delivery scheduling.

1.09 WARRANTY:

A. Furnish Manufacturer's:
   1. Warranty that materials furnished will perform as specified for a period of not less than one (1) year from material shipment when installed in accordance with Manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Basis of Design System: ALPRO® Wall Panel System shall be manufactured by Gordon, Inc. For all inquiries contact, Gordon, Inc., 5023 Hazel Jones Road, Bossier City, LA 71111, (888) 733-3836 or (800) 747-8954.
B. The listed Manufacturer shall not be construed as closing specifications to other prospective Manufacturers, but rather as establishing a level of quality in a metal system. Other systems may be submitted for approval, as provided for in the specifications at least ten (10) working days prior to submission of bids. Companies desiring to submit a proposal shall submit all descriptive information of the system proposed including photographs and Shop Drawings of at least three (3) projects similar in detail and scope.
C. Other Acceptable manufacturers: (must be integrated system with all components)
    a. Pac Clad
    b. Centria

2.02 PRODUCT CONSTRUCTION:

A. Acoustical Wall Panel System shall be manufactured of aluminum or steel components. All Panels, J Trim Perimeter, Corner Angles, and Z Furring, including Acoustical Components shall be provided as a complete package of this work.
B. Materials:
    1. Mounting Accessories:
        a. Brake formed aluminum or brake formed steel as manufactured by ALPRO®, Division of Gordon, Inc. or similar approved. Accessories shall include Z Furring, J Trim, and inside/outside Corner Angles in a size and length to completely support and finish/trim the Wall Panels as shown in elevations. All mounting accessories shall be finished to match corrugated Metal Wall Panels.
        b. General: Provide metals free from surface blemishes where exposed to view in finished unit. Surfaces that exhibit pitting, seam marks, roller marks, stains, and discolorations, or other imperfections on finished units are not acceptable. All metal shall be of the highest-grade commercial type.
    2. Metal Panels:
        a. For aluminum Panels, aluminum sheet shall be 3003-H14 alloy, minimum 0.032'' (ASTM B209). Panels may be stucco-embossed or smooth aluminum.
        b. For steel Panels, steel sheet shall be 22, 24, or 26 Gauge galvanneal.
        c. The metal acoustical Ceiling Panels shall be corrugated using ALPRO® pattern type [A-O].
        d. For perforated Panels, patterns to be 1/8'' diameter holes on 21/64'' staggered centers, approximately 13% open area.
    3. Sound Absorption Material:
        a. Provide fiberglass 2'' thickness X 1.5 # density. The fiberglass Panel shall be wrapped in Class A, per ASTM E84, Black PVC.

2.03 FINISHES:

A. All Acoustical Metal Panels and accessories shall receive a multi-stage pretreatment prior to receiving an electrostatically applied, AAMA 2604 powder coating finish.
B. All cut edges, including perforated holes, must be coated. Finish shall be oven baked to ensure paint adhesion and uniform surface hardness.
C. Paint color to be selected from Manufacturer's Standard Colors.

2.04 FABRICATION:

A. Provide all necessary mounting accessories for Wall Panel System.
B. Provide stock-sized Panel to be field cut.

PART 3 EXECUTION

3.01 EXAMINATION:

A. Examination of Surfaces: Examine building structure scheduled to receive Wall Panel System for unevenness or irregularities that would affect quality and execution of work.
B. Tolerances: Install Wall Panel System with a maximum surface deviation of 1/8'' in 4'-0'' (No load applied).

3.02 PREPARATION:

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the Manufacturer to achieve the best result for the project conditions.

3.03 INSTALLATION:

A. General: Comply with Manufacturer's printed instructions, governing regulations for Seismic Codes, and the Ceiling & Interior Systems Construction Association Standards applicable to work.
B. Space Enclosure: Do not install any work until space is enclosed and weatherproofed, wet-work in space is completed and nominally dry, work above ceilings is complete, and temperature and humidity shall be continuously maintained at values near those of final occupancy.

3.04 CLEANING:

A. Follow Manufacturer's cleaning instructions for specified finish.

3.05 PROTECTION:

A. Procedures: Care should be taken during the remainder of construction to protect Acoustical Wall Panel System from damage.
B. Damage to Finished Work: Finished units shall be without damage. Damage shall be repaired by the Contractor at the expense of the party damaging the material, as in accordance with the contract requirements.

END OF SECTION

SECTION 09 84 13

ACOUSTICAL WALL PANELS

PART 1 – GENERAL

1.1 SUMMARY
A. Section Includes:

1. 3form Elements Hush Blocks
2. Acoustic felt wall features
3. Various depths and shapes

1.2 REFERENCES
A. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
B. NRC Rating: 0.80 - 1.25 (varies by depth)
C. Fire Rating: Class A (US only)
D. Environmental Standards: LEED v4.1, Living Building Challenge, WELL Building Certification

1.3 SUBMITTALS
A. Product Data: Manufacturer's product specifications and installation instructions
B. Samples: Physical samples of Sola Felt blocks in selected shapes and depths
C. Certifications: Environmental declarations (EPD, Declare Label, Greenguard Gold)
D. Shop Drawings: CAD/Revit files for layout and configuration

1.4 QUALITY ASSURANCE
A. Manufacturer Qualifications: 3form Elements or approved equal
B. Mockups: Provide a sample panel for approval prior to full installation

1.5 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials in manufacturer's original packaging
B. Store in a dry, climate-controlled area
C. Handle with care to prevent damage to edges and surfaces

PART 2 – PRODUCTS

2.1 MANUFACTURER
A. 3form Elements
B. Product: Hush Blocks – Model 300.43

2.2 MATERIALS
A. Material: Sola Felt, ¼" (6mm) thick
B. Available Shapes: Six different block shapes
C. Available Depths: 2", 4", 6", and 8"
D. Color Options: Monochromatic, Gray, Blue, Green, Colorful
E. NRC Rating: 0.80 - 1.25 (depending on block depth)
F. Fire Rating: Class A (US only)
G. Weight: Not weight bearing, no more than 10 lbs/ft evenly distributed

2.3 SUSTAINABILITY
A. Environmental Certifications:

1. 3form Sola Felt Walls Type III EPD
2. 3form Sola Greenguard Gold
3. Sola Felt Declare Label (Red List Free)

PART 3 – EXECUTION

3.1 EXAMINATION
A. Verify wall conditions are suitable for installation
B. Ensure surfaces are clean and dry before installation

3.2 INSTALLATION
A. Install per manufacturer's instructions
B. Attach blocks directly to the wall using screws
C. Ensure proper spacing and alignment per design layout
D. Avoid exceeding weight limitations

3.3 CLEANING AND MAINTENANCE
A. Clean with a dry or lightly dampened cloth
B. Avoid harsh chemicals that could damage felt material

3.4 PROTECTION
A. Protect installed panels from damage during construction
B. Repair or replace damaged panels as directed by the architect

3.5 SCHEDULE
A. Protect installed panels from damage during construction
B. Repair or replace damaged panels as directed by the architect

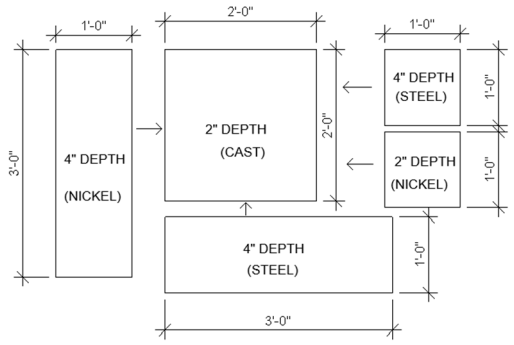
3.6 FINISH SCHEDULE

A. Depth selection and color selection as approved by owner and Architect
B. Refer to sheet A405 for height installation and spacing between panels, as well as sketch of *3Form* Hush Blocks selection.

Each Acoustical Panel group includes.

- 1 Hush Block Acoustical Panel 1" x 3", 4" depth in the color "Nickel"
- 1 Hush Block Acoustical Panel 1" x 3", 4" depth in the color "Steel"
- 1 Hush Block Acoustical Panel 2" x 2", 2" depth in the color "Cast"
- 1 Hush Block Acoustical Panel 1" x 1", 4" depth in the color "Steel"
- 1 Hush Block Acoustical Panel 1" x 1", 2" depth in the color "Nicker"

ACOUSTICAL PANEL PATTERN



END OF SECTION 09 84 13

SECTION 09 91 13

EXTERIOR LOW VOC PAINTS AND COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A Exterior paint and coating systems.

1.2 RELATED SECTIONS

A Section 05 05 13 - Shop Applied Coatings for Metal

B Section 06 01 40 - Architectural Woodwork Refinishing

C Section 06 05 83 - Shop Applied Wood Coatings

D Section 07 19 00 - Water Repellents

E Section 09 67 00 - Fluid Applied Flooring for Concrete

F Section 09 93 00 - Stains and Transparent Finishes

G Section 09 96 00 - High-Performance Coatings

1.3 REFERENCES

A SSPC-SP 1 - Solvent Cleaning

B SSPC-SP 2 - Hand Tool Cleaning

C SSPC-SP 3 - Power Tool Cleaning

D SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete

E EPA-Method 24

1.4 SUBMITTALS

A Submit under provisions of Section 01 33 00, Submittal Procedures.

B Product Data: Manufacturer's data sheets on each paint and coating product should include:

1 Product characteristics
2 Surface preparation instructions and recommendations
3 Primer requirements and finish specification
4 Storage and handling requirements and recommendations
5 Application methods

6 Cautions

C Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's color samples available.

D Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.

1.5 MOCK-UP

A Finish surfaces for verification of products, colors, & sheens
B Finish area designated by Architect
C Provide samples that designate prime & finish coats
D Do not proceed with remaining work until the Architect approves the mock-up samples
E Construct mockup panel, 4-feet long by 4-feet wide, illustrating special coating color, texture, and finish.
F Construct exterior door and frame assembly illustrating paint, texture, and finish.
G Contractor may incorporate accepted mockup as part of Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturers name, label, and the following list of information:

1 Product name, and type (description)
2 Application & use instructions
3 Surface preparation
4 VOC content
5 Environmental issues
6 Batch date
7 Color number

B Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

C Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.7 PROJECT CONDITIONS

A Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

B. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 (five) percent, but not less than 5 gallons of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A Acceptable Manufacturer:
The Sherwin-Williams Company Or Approved Equal During Bid Period
101 Prospect Avenue NW
Cleveland, OH 44115
Tel: (800) 321-8194
Fax: (216) 566-1392
www.sherwin-williams.com

B Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 Product Requirements.
When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product.

2.2 APPLICATIONS/SCOPE

A Refer to Finish Schedule on the drawings and information included in this section.

B Surfaces To Be Coated (UNLESS NOTED OTHERWISE):

Metal: Aluminum, Galvanized
Metal: Misc. Iron, Ornamental Iron, Ferrous Metal
Drywall: Gypsum Board, and Exterior Drywall

2.3 SCHEDULE

A. CONCRETE - (Stucco, Tilt-up, Precast, and Poured-in-place Cement)

1. Textured System (to be used specifically at all exterior faces of all tilt-up concrete panels)
   a. Textured Finish
      1st Coat: COOLWALL Textured Primer
      (180 square feet per gallon)
      2nd Coat: TEX-COTE COOLWALL SUPER-COTE
      (180 square feet per gallon)
      3rd Coat: TEX-COTE COOLWALL SUPER-COTE
      (180 square feet per gallon)

D. METAL - (Aluminum, Galvanized)

1. Latex Systems
   a. Gloss Finish

      HI-PERFORMANCE
      1st Coat: S-W Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series
      2nd Coat: S-W Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series
      (2.5-4 mils dry per coat)

   b. Semi-Gloss Finish

      HI-

PERFORMANCE
1st Coat: S-W Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series
2nd Coat: S-W Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series
(2.5-4 mils dry per coat)

c. Satin Finish
1st Coat: S-W A-100 Exterior Latex Satin, A82 Series
2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series
(4 mils wet, 1.4 mils dry per coat)

d. Flat Finish
1st Coat: S-W A-100 Exterior Latex Flat, A6 Series
2nd Coat: S-W A-100 Exterior Latex Flat, A6 Series
(4 mils wet, 1.4 mils dry per coat)

2. Urethane System Water Based
a. Gloss Finish
1st Coat: S-W Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series
(5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Waterbased Acrolon™ 100 Urethane, B65W720 Series
3rd Coat: S-W Waterbased Acrolon™ 100 Urethane, B65W720 Series
(2-4 mils dry per coat)

E. METAL - (Misc. Iron, Ornamental Iron, Structural Iron & Steel, Ferrous Metal)

1. Latex Systems
a. Gloss Finish

HI-PERFORMANCE
1st Coat: S-W Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series
(5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series
3rd Coat: S-W Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series
(2.5-4 mils dry per coat)

b. Semi-Gloss Finish

HI-

PERFORMANCE
1st Coat: S-W Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series
(5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series
3rd Coat: S-W Pro Industrial™ Zero VOC Semi-Gloss Acrylic, B66-650 Series
(2.5-4 mils dry per coat)

2. Urethane System Water Based
   a. Gloss Finish
      1st Coat: S-W Pro Industrial™ Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
      2nd Coat: S-W Waterbased Acrolon™ 100 Urethane, B65W720 Series
      3rd Coat: S-W Waterbased Acrolon™ 100 Urethane, B65W720 Series (2-4 mils dry per coat)

G. WOOD (Siding, Trim, Shutters, Sashes, Hardboard-Bare/Primed)

   a. Semi-Gloss Finish
      1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
      2nd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series
      3rd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series (4 mils wet, 1.5 mils dry per coat)

   b. Satin Finish
      1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
      2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series
      3rd Coat: S-W A-100 Exterior Latex Satin, A82 Series (4 mils wet, 1.4 mils dry per coat)

   c. Flat Finish
      1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
      2nd Coat: S-W A-100 Exterior Latex Flat, A6 Series
      3rd Coat: S-W A-100 Exterior Latex Flat, A6 Series (4 mils wet, 1.4 mils dry per coat)

H. DRYWALL (Gypsum Board, Exterior Drywall)

1. Latex Systems
   a. Gloss Finish
      1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
      2nd Coat: S-W A-100 Exterior Latex Gloss, A8W100 Series 3rd Coat: S-W A-100 Exterior Latex Gloss, A8W100 Series (4 mils wet, 1.3 mils dry per coat)

   b. Semi-Gloss Finish
      1st Coat: S-W Exterior Latex Wood Primer, B42W8041 (4 mils wet, 1.4 mils dry)
      2nd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series
      3rd Coat: S-W Metalatex Acrylic Semi-Gloss, B42 Series (4 mils wet, 1.5 mils dry per coat)

c. Satin Finish
1st Coat: S-W Exterior Latex Wood Primer, B42W8041
(4 mils wet, 1.4 mils dry)
2nd Coat: S-W A-100 Exterior Latex Satin, A82 Series
3rd Coat: S-W A-100 Exterior Latex Satin, A82 Series
(4 mils wet, 1.4 mils dry per coat)

d. Flat Finish
1st Coat: S-W Exterior Latex Wood Primer, B42W8041
(4 mils wet, 1.4 mils dry)
2nd Coat: S-W A-100 Exterior Latex Flat, A6 Series
3rd Coat: S-W A-100 Exterior Latex Flat, A6 Series
(4 mils wet, 1.4 mils dry per coat)

2.4 MATERIALS - GENERAL REQUIREMENTS

A Paints and Coatings - General:

1 Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such a procedure is specifically described in manufacturer's product instructions. VOC's need to be confirmed by using the products MSDS sheets.

2 VOC's. The VOC concentrations of the product shall not exceed those listed below. ….....The calculation of VOC shall exclude water and tinting color added at the point of sale.

Exterior Coatings:

Coating Type	VOC weight in grams/liter of product minus water
Non-flat	50
Flat	50
Primer	100
Stain	100
Low Solids*	120
Waterproofing:	
Concrete/Masonry	100
Industrial	100
Floor	100

* Low Solids In g/L (grams per liter), not less water

B Primers:

1 Where the manufacturer specifies products, the VOC limits follow the rules set forth above. These coatings are intended for on-site application to exterior surfaces of

residential, commercial,
institutional or industrial buildings.

2.5 ACCESSORIES:

A Coating Application Accessories:

1 Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean -up materials required per manufacturer's specifications.

PART3 EXECUTION

3.1 EXAMINATION

A Do not begin application of coatings until substrates have been properly prepared. Notify Architect of unsatisfactory conditions before proceeding

B If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C Proceed with work only after conditions have been corrected, and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

3.2 SURFACE PREPARATION:

A Proper product selection, surface preparation, and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to the substrate and prolongs the service life of the coating system.

B Selection of the proper method of surface preparation depends on the substrate, the environment, and the expected service life of the coating system. Economics, surface contamination, and the effect on the substrate will also influence the selection of surface preparation methods.

C The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

D Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry 48 hours before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

E. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50°F, unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50°F or higher to use low temperature products.

F Methods:

1 Aluminum
Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.

2 Block (Cinder and Concrete)
Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and
mortar must be cured at least 30 days at 75°F, unless the manufactures products are designed for application prior to the 30-day period. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.

3 Concrete, SSPC-SP13 or NACE 6
This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

4 Cement Composition Siding/Panels
Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.

5 Copper and Stainless Steel
Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP 2, Hand Tool Cleaning.

6 Drywall—Exterior
Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting. Exterior surfaces must be spackled with exterior grade compounds.

7 Exterior Composition Board (Hardboard)
Some composition boards may exude a waxy material that must be removed with a solvent prior to coating. Whether factory primed or unprimed, exterior composition board siding (hardboard) must be cleaned thoroughly and primed with an alkyd primer.

8 Galvanized Metal
Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and

oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.

9 Steel: Structural, Plate, etc.
Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.

10 Solvent Cleaning, SSPC-SP1
Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.

11 Hand Tool Cleaning, SSPC-SP2
Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.

12 Power Tool Cleaning, SSPC-SP3
Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.

13 White Metal Blast Cleaning, SSPC-SP5 or NACE 1
A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter.
Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

14 Commercial Blast Cleaning, SSPC-SP6 or NACE 3
A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of
surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

15 Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4
A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other

agreed upon methods.

16 Power Tool Cleaning to Bare Metal, SSPC-SP11
Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.

17 Near-White Blast Cleaning, SSPC-SP10 or NACE 2
A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust,
stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

18 High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials
SSPC-SP12 or NACE 5
This standard provides requirements for the use of high- and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.

19 Water Blasting, NACE Standard RP-01-72
Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.

20 Stucco
Must be clean and free of any loose stucco. If recommended procedures for applying stucco are followed, and normal drying conditions prevail, the surface may be painted in 30 days. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments such as Loxon®.

21 Wood—Exterior
Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

22 *Vinyl Siding, Architectural Plastics, EIFS and Fiberglass
Clean thoroughly by scrubbing with a warm, soapy water solution. Rinse thoroughly. Do not paint with any color darker than the original color, unless the product and color are designed for such use. Painting with darker colors may cause warping.

WARNING! Removal of old paint by sanding, scraping or other means may generate dust or fumes that contain lead. Exposure to lead dust or fumes may cause brain damage or other adverse health effects, especially in children or pregnant women. Controlling

exposure to lead or other hazardous substances requires the use of proper protective equipment, such as a properly fitted respirator (NIOSH approved) and proper containment and cleanup.
For more information, call the National Lead Information Center at 1-800-424-LEAD (in US) or contact your local health authority.

3.3 INSTALLATION

A Apply all coatings and materials with manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendation.

B Do not apply to wet or damp surfaces.

1 Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days.
2 Test new concrete for moisture content.
3 Wait until wood is fully dry after rain or morning fog or dew.

C Apply coatings using methods recommended by manufacturer.

D Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

E Apply coatings at spreading rate required to achieve the manufacturer's recommended dry film thickn ess.

F Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G Exterior Woodwork: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 2 weeks.

H Inspection: The coated surface must be inspected and approved by the Architect or Engineer just prior to each coat.

3.4 PROTECTION

A Protect finished coatings from damage until completion of project.

B Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.....

END OF SECTION

SECTION 09 91 23

INTERIOR PAINTS AND COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A Interior paint and coatings systems

1.2 RELATED SECTIONS

A Section 01 81 13 – Sustainable Design Requirements

B Section 05 05 13 - Shop Applied Coatings for Metal

C Section 06 01 40 - Architectural Woodwork Refinishing

D Section 06 05 83 - Shop Applied Wood Coatings

E Section 07 19 00 - Water Repellents

F Section 09 67 00 - Fluid Applied Flooring for Concrete

G Section 09 93 00 - Stains and Transparent Finishes

H Section 09 96 00 - High-Performance Coatings

1.3 REFERENCES

A SSPC-SP 1 - Solvent Cleaning

B SSPC-SP 2 - Hand Tool Cleaning

C SSPC-SP 3 - Power Tool Cleaning

D SSPC-SP 13 / Nace No. 6 Surface Preparation for Concrete

E EPA-Method 24

F GS-11 May 1993, GC-03, SCAQMD

G LEED09-NC/CI/CS USGBC w/addenda 11/03/2010

1.4 SUBMITTALS

A Submit under provisions of Section 01 33 00, Submittal Procedures.

B Product Data: Manufacturer's data sheets on each paint and coating product should include:

1 Product characteristics
2 Surface preparation instructions and recommendations
3 Primer requirements and finish specification
4 Storage and handling requirements and recommendations
5 Application methods
6 Cautions, VOCs

C Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's color samples available.

D Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.

E LEED Submittals: For Credit EQ 4.2, manufacturers' product data for paints, including printed statement of VOC content and chemical components.

1.5 MOCK-UP

A Finish surfaces for verification of products, colors, & sheens
B Finish area designated by Architect
C Provide samples that designate prime & finish coats
D Do not proceed with remaining work until the Architect approves the mock-up samples
E Construct mockup panel, 4-feet long by 4-feet wide, illustrating special coating color, texture, and finish.
F Construct door and frame assembly illustrating paint stain and varnish coating color, texture, and finish .
G Contractor may incorporate accepted mockup as part of Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information:

Product name, and type
(description) Application & use
instructions Surface preparation
VOC content
Environmental issues
Batch date
Color number/name

B Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

C Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.7 PROJECT CONDITIONS

A Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coating s under environmental conditions outside
manufacturer's absolute limits.

B. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 (five) percent, but not less than 5 gallons of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A Acceptable Manufacturer:
The Sherwin-Williams Company Or Approved Equal During Bid Period 101 Prospect Avenue NW
Cleveland, OH 44115
Tel: (800) 321-8194
Fax: (216) 566-1392
www.sherwin-williams.com

B Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 Product Requirements.
When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product.

2.2 APPLICATIONS/SCOPE

A Refer to Finish Schedule on the drawings and information included in this section.

B Surfaces To Be Coated:
1. Concrete - Poured, Precast, Tilt-Up, Cast-In-Place, Cement Board Including Plaster exposed to view unless noted otherwise.
2. Masonry - (CMU - Concrete, Split Face, Scored, Smooth, etc.) exposed to view unless noted otherwise.
3. Metal - Galvanized, Steel exposed to view unless noted otherwise.
4. Metal -(Structural Steel, Joists, Trusses, Beams, Misc. & Ornamental Iron, Ferrous Metal conduits and pipes) including Dryfall exposed to view unless noted otherwise.
5. Wood - Walls, Ceilings, Doors, Trim exposed to view unless noted otherwise.
6. Drywall exposed to view unless noted otherwise.
7. Concrete Floors exposed to view unless noted otherwise.

PRODUCTS	**LEED-09 NC/CI/CS CATEGORY**	**PRODUCT VOCs**
Waterbased DryFall Flat B42W81	**DRY FOG FLAT**	**<50 g/L**
Waterbased DryFall Eg-Shel, B42W82 & Semi-Gloss B42W83	**DRY FOG NON-FLAT**	**<50 g/L**
Duration Home® Interior Latex Matte, A96-Series	**FLAT**	**<50 g/L**
Harmony® Low Odor Interior Latex Flat, B5 Series	**FLAT**	**0**

ProGreen® 200 Interior Latex Flat, B30-600 Series & ProGreen® 200 Low Sheen, B20-1600 Series	**FLAT**	**<50 g/L**
ProMar® 200 Zero VOC Latex Flat B30-2600 & Low Sheen B24-2600 Series	**FLAT**	**0**
ProMar® 400 Interior Latex Flat, B30W451	**FLAT**	**<50 g/L**
Porch & Floor Enamel, A32 Series	**FLOOR**	**<50 g/L**
Bond-Plex, B71W211 & B71T204	**NON-FLAT**	**<150 g/L**
Duration Home Latex Satin, A97 & Duration Home Semi-Gloss, A98-Series	**NON-FLAT**	**<50 g/L**
Harmony® Low Odor Latex Eg-Shel, B9 Series & Harmony® Semi-Gloss, B10	**NON-FLAT**	**0**

Series		
ProClassic Interior Waterbased Acrylic-Alkyd Satin & Semi-Gloss, B33 & B34-850 Series	**NON-FLAT**	**<50 g/L**
ProClassic® Waterborne Acrylic Satin, S/G, Gloss & High Gloss Enamels, B20 Series, B31, & B21Series	**NON-FLAT**	**<150 g/L**
ProGreen® 200 Latex Eg-Shel, B20-600 & Semi-Gloss, B31-600 Series	**NON-FLAT**	**<50 g/L**
Pro Industrial™ Zero VOC Acrylic Gloss & S/G, B66-600 Series	**NON-FLAT**	**0**
Pro Industrial™ Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series	**NON-FLAT**	**0**
Pro Industrial™ Industrial Enamel 100, B54WZ211 Series	**NON-FLAT**	**<100 g/L**
Pro Industrial™ Multi-Surface Acrylic, B66W501, B66T504	**NON-FLAT**	**<150 g/L**
Pro Industrial Pre-Catalyzed W/B Epoxy Eg-Shel K45W150 & Semi-Gloss, K46W150 Series	**NON-FLAT**	**<150 g/L**
ProMar® 200 Zero VOC Latex Eg-Shel, B20-2600 & Semi-Gloss, B31-2600 Series	**NON-FLAT**	**0**
ProMar® 200 Interior Waterbased Acrylic-Alkyd Eg-Shel/Semi-Gloss/Gloss B33-8251, B34-8251 & B35-8251	**NON-FLAT**	**<100 g/L**
ProMar® 200 Latex Eg-Shel, B20W2251 & B20W2253 & ProMar® 200 Semi- Gloss, B31W2251 & B31W2253	**NON-FLAT**	**<150 g/L**
ProMar® 400 Latex Eg-Shel, B20W4451 & B20W4453 & ProMar® 400 Semi- Gloss, B31W4451 & B31W4453	**NON-FLAT**	**<150 g/L**
***Waterbased Acrolon 100, B65W721 Series**	**NON-FLAT**	**<100 g/L**
***Waterbased Catalyzed Epoxy, B70W211 B60V15/B60V25**	**NON-FLAT**	**<150 g/L**

Adhesion Primer, B51W8050	**PRIMER-FLAT**	**<50 g/L**
Harmony® Low Odor Interior Latex Primer, B11	**PRIMER-FLAT**	**0**
ProGreen® 200 Interior Latex Primer, B28W600	**PRIMER-FLAT**	**<50 g/L**
Pro Industrial™ Pro-Cryl® Universal Primer B66-310 Series	**PRIMER NON-FLAT**	**<100 g/L**
Loxon® Masonry Primer, A24W8300	**SEALERS**	**<100 g/L**
Premium Wall & Wood Primer, B28W8111	**SEALERS**	**<50 g/L**
PRODUCTS	**LEED-09 NC/CI/CS CATEGORY**	**PRODUCT VOCs**
PrepRite® Block Filler, B25W25	**SEALER UNDERCOATER**	**<50 g/L**
Loxon® Block Surfacer, A24W200	**SEALER UNDERCOATER**	**<100 g/L**
WoodClassics 250 VOC Stains, Minwax 250 VOC Stains,	**STAINS**	**<250 g/L**
WoodClassics WB Polyurethane, A68 Series	**VARNISH**	**<350 g/L**

2.3 SCHEDULE

A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up, Cast-In-Place) including PLASTER - (Walls, Ceilings)

1. Latex Systems

a. Gloss Finish

1st Coat: S-W Loxon Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W ProMar 200 Latex Gloss B21-200 Series 3rd Coat: S-W ProMar 200 Latex Gloss B21-200 Series (4 mils wet, 1.5 mils dry per coat)

HI-Performance – 0 VOC Finish
1st Coat: S-W Loxon Acrylic Masonry Primer, A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series 3rd Coat: S-W Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series (2.5-4 mils dry per coat)

b. Semi-Gloss Finish

Low Odor – Zero VOC Finish
1st Coat: S-W Loxon Acrylic Masonry Primer,

A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.7 mils dry per coat)

HI-Performance – Zero VOC Finish
1st Coat: S-W Loxon Acrylic Masonry Primer,
A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series 3rd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series
(2.5-4 mils dry per coat)

c. Eg-Shel / Satin Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Loxon Acrylic Masonry Primer,
A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
(4 mils wet, 1.6 mils dry per coat)

d. Low Sheen Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Loxon Acrylic Masonry Primer,
A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series
(4 mils wet, 1.7 mils dry per coat)

e. Flat Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Loxon Acrylic Masonry Primer,
A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series
(4 mils wet, 1.6 mils dry per coat)

2. Alkyd System
a. Gloss Finish (Water Base)
1st Coat: S-W Loxon Acrylic Masonry Primer,
A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series
(4 mils wet, 1.7 mils dry per coat)

b. Semi-Gloss Finish (Water Base)
1st Coat: S-W Loxon Acrylic Masonry Primer,

A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series
(4 mils wet, 1.7 mils dry per coat)

c. Eg-Shel Finish (Water Base)
1st Coat: S-W Loxon Acrylic Masonry Primer,
A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Eg-Shel, B33-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Eg-Shel, B33-8200 Series
(4 mils wet, 1.4 mils dry per coat)

3. Epoxy Systems (Water Base)
a. Gloss Finish
1st Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15 2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15
(2.5 - 3 mils dry per coat)

b. Semi -Gloss Finish
1st Coat: S-W Loxon Acrylic Masonry Primer,
A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-151 Series 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-151 Series
(4 mils wet, 1.5 mils dry per coat)

c. Eg-Shel/Low Luster Finish
1st Coat: S-W Loxon Acrylic Masonry Primer,
A24W8300 (8 mils wet, 3.2 mils dry)
2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-151 Series 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-151 Series
(4 mils wet, 1.5 mils dry per coat)

Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-360 Series 2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-360 Series
(2.0- 4 mils dry per coat)

B. CONCRETE- (Ceilings)
1. Dryfall Waterborne Systems
a. Semi-Gloss Finish
1st Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W83 2nd Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W83
(11 mils wet, 4.5 mils dry per coat)

b. Eg-Shel Finish
1st Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W82 2nd Coat: S-W Low VOC Waterborne Acrylic

Dryfall, B42W82
(11 mils wet, 4.5 mils dry per coat)

c. Flat Finish
1st Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W81 2nd Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W81
(11 mils wet, 4.5 mils dry per coat)

C. MASONRY - (CMU - Concrete, Split Face, Scored, Smooth, High Density, Low Density, Fluted)

1. Latex Systems

a. Gloss Finish
1st Coat: S-W PrepRite® Block Filler, B25W25 (75-125 sq ft/gal)
2nd Coat: S-W ProMar 200 Latex Gloss B21-200 Series 3rd Coat: S-W ProMar 200 Latex Gloss B21-200 Series (4 mils wet, 1.5 mils dry per coat)

HI-Performance – Zero VOC Finish
1st Coat: S-W PrepRite® Block Filler, B25W25 (75-125 sq ft/gal)
2nd Coat: S-W Pro Industrial Zero VOC Gloss Acrylic, B66-600 Series 3rd Coat: S-W Pro Industrial Zero VOC Gloss Acrylic, B66-600 Series
(2.5-4 mils dry per coat)

b. Semi-Gloss Finish
Low Odor – Zero VOC Finish
1st Coat: S-W PrepRite® Block Filler, B25W25 (75-125 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.7 mils dry per coat)

c. Eg-Shel / Satin Finish
Low Odor - Zero VOC Finish
1st Coat: S-W PrepRite Block Filler, B25W25 (75-125 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
(4 mils wet, 1.6 mils dry per coat)

d. Low Sheen Finish
1st Coat: S-W PrepRite® Block Filler, B25W25 (75-125 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series
(4 mils wet, 1.7 mils dry per coat)

e. Flat Finish
Low Odor - Zero VOC Finish

1st Coat: S-W PrepRite® Block Filler, B25W25 (75-125 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series (4 mils wet, 1.6 mils dry per coat)

2. Alkyd System
   a. Gloss Finish (Water Base)
      1st Coat: S-W Loxon® Block Surfacer, A24W200 (50-100 sq ft/gal)
      2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series
      (4 mils wet, 1.7 mils dry per coat)

   b. Semi-Gloss Finish (Water Base)
      1st Coat: S-W Loxon® Block Surfacer, A24W200 (50-100 sq ft/gal)
      2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series
      (4 mils wet, 1.7 mils dry per coat)

   c. Eg-Shel Finish (Water Base)
      1st Coat: S-W Loxon® Block Surfacer, A24W200 (50-100 sq ft/gal)
      2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Eg-Shel, B33-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Eg-Shel, B33-8200 Series
      (4 mils wet, 1.4 mils dry per coat)

3. Epoxy System (Water Base)
   a. Gloss Finish
      1st Coat: S-W Loxon Block Surfacer, A24W200 (50-100 sq ft/gal)
      2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15 3rd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15
      (2.5 - 3 mils dry per coat)

      Low Odor - Zero VOC Finish
      1st Coat: S-W Loxon Block Surfacer, A24W200 (50-100 sq ft/gal)
      2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series 3rd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series
      (2.0- 4 mils dry per coat)

   b. Semi -Gloss Finish
      1st Coat: S-W Loxon Block Surfacer, A24W200 (50-100 sq ft/gal)
      2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 3rd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25
      (2.5 - 3 mils dry per coat)

c. Eg-Shel/Low Luster
Finish Low Odor - Zero
VOC Finish
1st Coat: S-W Loxon Block Surfacer,
A24W200 (50-100 sq ft/gal)
2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-360 Series 3rd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-360 Series
(2.0- 4 mils dry per coat)

D. METAL - (Aluminum, Galvanized)
1. Latex Systems
a. Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Latex Gloss Enamel, B21-200 Series 3rd Coat: S-W ProMar 200 Latex Gloss Enamel, B21-200 Series
(4 mils wet, 1.5 mils dry per coat)

HI-Performance – Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Gloss Acrylic, B66-600 Series 3rd Coat: S-W Pro Industrial Zero VOC Gloss Acrylic, B66-600 Series
(2.5-4 mils dry per coat)

b. Semi-Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series
(4 mils wet, 1.4 mils dry per coat)

Low Odor – Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.7 mils dry per coat)

c. Eg-Shell / Satin Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProClassic Waterborne Acrylic Satin, B20 Series 3rd Coat: S-W ProClassic Waterborne Acrylic Satin, B20 Series
(4 mils wet, 1.4 mils dry per coat)

Low Odor - Zero VOC Finish

1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
(4 mils wet, 1.6 mils dry per coat)

d. Low Sheen Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series
(4 mils wet, 1.7 mils dry per coat)

e. Flat Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series
(4 mils wet, 1.6 mils dry per coat)

2. Alkyd System
a. Gloss Finish (Water base)
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series
(4 mils wet, 1.7 mils dry per coat)

b. Semi-Gloss Finish (Water Base)
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series
(4 mils wet, 1.7 mils dry per coat)

3. Epoxy System (Water Base)
a. Gloss Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series 3rd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series
(2.0- 4 mils dry per coat)

b. Semi -Gloss Finish

1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 3rd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25
(2.5 - 3 mils dry per coat)

c. Eg-Shel/Low Luster Finish Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-360 Series 3rd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-360 Series
(2.0- 4 mils dry per coat)

4. Urethane System (Water Base)
a. Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Waterbased Acrolon 100, B65W720 series 3rd Coat: S-W Waterbased Acrolon 100, B65W720 series
(2-4 mils dry per coat)

E. METAL - (Galvanized; Ceilings, Duct work)
1. Multi-Surface Acrylic Coating System
a. Gloss Finish HI-Performance Finish
1st Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series 2nd Coat: S-W Pro Industrial Multi-Surface Acrylic, B66-500 Series
(1.5 - 2 mils dry per coat)

2. Dryfall Waterborne Topcoats:
a. Semi-Gloss Finish
1st Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W83 2nd Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W83
(11 mils wet, 4.5 mils dry per coat)

b. Eg-Shel Finish
1st Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W82 2nd Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W82
(11 mils wet, 4.5 mils dry per coat)

c. Flat Finish
1st Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W81 2nd Coat: S-W Low VOC Waterborne Acrylic Dryfall, B42W81

(11 mils wet, 4.5 mils dry per coat)

F. METAL - (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Structural Iron, Ferrous Metal)

1. Latex Systems

a. Gloss Finish

1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProClassic Waterborne Acrylic Gloss, B21-51 Series 3rd Coat: S-W ProClassic Waterborne Acrylic Gloss, B21-51 Series
(4 mils wet, 1.6 mils dry per coat)

HI-Performance – Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Gloss Acrylic, B66-600 Series 3rd Coat: S-W Pro Industrial Zero VOC Gloss Acrylic, B66-600 Series
(2.5-4 mils dry per coat)

b. Semi-Gloss Finish

Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.7 mils dry per coat)

HI-Performance – Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series 3rd Coat: S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series
(2.5-4 mils dry per coat)

c. Eg-Shel / Satin Finish

Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
(4 mils wet, 1.6 mils dry per coat)

HI-Performance – Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial® Zero VOC Satin Acrylic B66-660 Series 3rd Coat: S-W Pro Industrial® Zero VOC Satin Acrylic

B66-660 Series

(2.5 - 4.0 mils dry per coat)

d. Low Sheen Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series
(4 mils wet, 1.7 mils dry per coat)

e. Flat Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series
(4 mils wet, 1.6 mils dry per coat)

2. Alkyd System
a. Gloss Finish (Water Base)
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series
(4 mils wet, 1.7 mils dry per coat)

b. Semi-Gloss Finish (Water Base)
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series
(4 mils wet, 1.7 mils dry per coat)

3. Epoxy System (Water Base)
a. Gloss Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series 3rd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series
(2.0- 4 mils dry per coat)

b. Semi -Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-151 Series 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-151 Series

(4 mils wet, 1.5 mils dry per coat)

c. Eg-Shel/Low Luster
Finish Low Odor - Zero
VOC Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310
Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-
360 Series 3rd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed
Epoxy, B73-360 Series
(2.0- 4 mils dry per coat)

4. Urethane System (Water Base)
a. Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310
Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Waterbased Acrolon 100, B65W720
series 3rd Coat: S-W Waterbased Acrolon 100,
B65W720 series
(2-4 mils dry per coat)

5. Dryfall Waterborne
Topcoats
a. Semi-Gloss Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310
Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Low VOC Waterborne Acrylic Dryfall,
B42W83 3rd Coat: Optional
(11 mils wet, 4.5 mils dry per coat)

b. Eg-Shel Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310
Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Low VOC Waterborne Acrylic Dryfall,
B42W82 3rd Coat: Optional
(11 mils wet, 4.5 mils dry per coat)

c. Flat Finish
1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310
Series (5-10 mils wet, 2-4 mils dry)
2nd Coat: S-W Low VOC Waterborne Acrylic Dryfall,
B42W81 3rd Coat: Optional
(11 mils wet, 4.5 mils dry per coat)

G. WOOD - (Walls, Ceilings, Doors, Trim,)
1. Latex Systems
a. Gloss Finish
1st Coat: S-W Premium Wall & Wood Primer,
B28W8111 (4 mils wet, 1.8 mils dry)
2nd Coat: S-W ProClassic Waterborne Acrylic Gloss, B21-51
Series 3rd Coat: S-W ProClassic Waterborne Acrylic
Gloss, B21-51 Series
(4 mils wet, 1.6 mils dry per coat)

b. Semi - Gloss Finish

1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4 mils wet, 1.8 mils dry)
2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series
(4 mils wet, 1.4 mils dry per coat)

c. Eg-Shel / Satin Finish
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4 mils wet, 1.8 mils dry)
2nd Coat: S-W ProClassic Waterborne Acrylic Satin, B20 Series 3rd Coat: S-W ProClassic Waterborne Acrylic Satin, B20 Series
(4 mils wet, 1.4 mils dry per coat)

d. Flat Finish
Low Odor - Zero VOC Finish
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4 mils wet, 1.8 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series
(4 mils wet, 1.6 mils dry per coat)

2. Alkyd System

a. Gloss Finish (Water base)
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4 mils wet, 1.8 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Gloss, B35-8200 Series
(4 mils wet, 1.7 mils dry per coat)

b. Semi-Gloss Finish (Water Base)
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4 mils wet, 1.8 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Semi-Gloss, B34-8200 Series
(4 mils wet, 1.7 mils dry per coat)

c. Eg-Shel Finish (Water Base)
1st Coat: S-W Premium Wall & Wood Primer, B28W8111 (4 mils wet, 1.8 mils dry)
2nd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Eg-Shel, B33-8200 Series 3rd Coat: S-W ProMar 200 Waterbased Acrylic/Alkyd Eg-Shel, B33-8200 Series
(4 mils wet, 1.4 mils dry per coat)

3. Stain and Varnish System

a. Gloss Finish
1st Coat: S-W WoodClassics 250 VOC Stains
2nd Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series 3rd Coat: S-W WoodClassics Waterborne Polyurethane

Varnish, A68 Series
(4 mils wet, 1.0 mil dry per coat)

b. Satin Finish
1st Coat: S-W WoodClassics 250 VOC Stains
2nd Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series 3rd Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series
(4 mils wet, 1.0 mil dry per coat)

H. DRYWALL - (Walls, Ceilings, Gypsum Board, etc.)

1. Latex Systems

a. Semi-Gloss Finish
Low Odor – Zero VOC Finish
1st Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 Series (4 mils wet, 1.5 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.7 mils dry per coat)

b. Eg-Shel / Satin Finish
Low Odor - Zero VOC Finish
1st Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 Series (4 mils wet, 1.5 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series
(4 mils wet, 1.6 mils dry per coat)

c. Low Sheen Finish
Low Odor - Zero VOC Finish
1st Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 Series (4 mils wet, 1.5 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series
(4 mils wet, 1.7 mils dry per coat)

d. Flat Finish
Low Odor - Zero VOC Finish
1st Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 Series (4 mils wet, 1.5 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series 3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series
(4 mils wet, 1.6 mils dry per coat)

2. Epoxy System (Water Base)

a. Gloss Finish

Low Odor - Zero VOC Finish
1st Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 (4 mils wet, 1.5 mils dry)

2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series 3rd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-300 Series
(2.0- 4 mils dry per coat)

b. Semi -Gloss Finish
1st Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 (4 mils wet, 1.5 mils dry)
2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 3rd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25
(2.5 - 3 mils dry per coat)

c. Eg-Shel/Low Luster

Finish Low Odor - Zero

VOC Finish
1st Coat: S-W ProGreen 200 Interior Latex Primer, B28W600
(4 mils wet, 1.5 mils dry)
2nd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-360 Series 3rd Coat: S-W Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, B73-360 Series

(2.0- 4 mils dry per coat)

I. Concrete - (Floors)
1. Latex Systems
a. Semi Gloss Finish
1st Coat: S-W Tread-Plex Acrylic Floor Coating, B90 Series 2nd Coat: S-W Tread-Plex Acrylic Floor Coating, B90 Series
3rd Coat: S-W Tread-Plex Acrylic Floor Coating, B90 Series
(optional) (1.5 - 2.0 mils dry, per coat)

b. Satin Finish
1st Coat: S-W Porch & Floor Enamel, A32-200 Series 2nd Coat: S-W Porch & Floor Enamel, A32-200 Series
(4 mils wet, 1.4 mils dry per coat)

2.4 MATERIALS - GENERAL REQUIREMENTS

A Paints and Coatings - General:
1 Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before applicati on. Do not reduce, thin, or dilute coatings or add materials to coatings unless such a procedure is specifically described in
manufacturer's product instructions. VOC numbers need to be confirmed by using the products MSDS sheets.

2 Requirements: USGBC LEED09-NC/CI/CS IEQ Credit 4.2: Per USGBC
•Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.

•Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

•Clear wood finishes, floor coatings, stains, primers, and shellacs applied to interior elements must not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004. Clear Wood Finishes: Varnish 350 g/L; Lacquer 550 g/L: Floor Coatings: 100 g/L Sealers: Waterproofing Sealers 250 g/L; Sanding Sealers 350 g/L; *Primers (see note below), Sealers, and Undercoaters 200 g/L , All Other Sealers 200 g/L Shellacs: Clear 730 g/L; Pigmented 550g/L
Interior Stains: 250 g/L

Sealers defined: “Sealers are coatings applied to either block materials from penetrating into or leaching out of a substrate, to prevent subsequent coatings from being absorbed by the substrate, or to prevent harm to subsequent coatings by materials in the substrate.”

* Addenda dated 11/03/2010 Table 1. IEQc4.2 Applicable VOC Limits now states: Interior Flat Coating or Primer follow Green Seal GS-11, 1993: 50 g/L Interior Non-Flat Coating or Primer follow Green Seal GS-11,1993: 150 g/L. Primers are spelled out to follow South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, effective January 1, 2004. Since this is contradictory, USGBC has confirmed that Primers are classified as Flat/Non-Flat and one should follow Table 1. Below
USGBC has omitted Industrial Maintenance Coatings from Table 1. IEQc4.2 addenda date 11/03/2010, those coatings shall be considered other categories within that table, e.g.
flat/ non-flat/floor/etc.

Source USGBC

Table 1. IEQc4.2 Applicable VOC Limits

Product Type	Referenced Standard	VOC Limit (g/L minus water)
Interior Flat Coating or Primer	Green Seal GS-11, 1993	50
Interior Non-Flat Coating or Primer	Green Seal GS-11, 1993	150
Anti-Corrosive/ Anti-Rust Paint	Green Seal GC-03, 2nd Edition, 1997	250
Clear Wood Finish: Lacquer	SCAQMD Rule 1113, 2004	550
Clear Wood Finish: Sanding Sealer	SCAQMD Rule 1113, 2004	350
Clear Wood Finish: Varnish	SCAQMD Rule 1113, 2004	350
Clear Brushing Lacquer	SCAQMD Rule 1113, 2004	680
Floor Coatings	SCAQMD Rule 1113, 2004	100
Sealers and Undercoaters	SCAQMD Rule 1113, 2004	200
Shellac: Clear	SCAQMD Rule 1113, 2004	730
Shellac: Pigmented	SCAQMD Rule 1113, 2004	550
Stain	SCAQMD Rule 1113, 2004	250
Concrete Curing Compounds	SCAQMD Rule 1113, 2004	350
Japans/ Faux Finishing Coatings	SCAQMD Rule 1113, 2004	350
Magnesite Cement Coatings	SCAQMD Rule 1113, 2004	450
Pigmented Lacquer	SCAQMD Rule 1113, 2004	550
Waterproofing Sealers	SCAQMD Rule 1113, 2004	250
Waterproofing: Concrete/MasonrySealers	SCAQMD Rule 1113, 2004	400
Wood Preservatives	SCAQMD Rule 1113, 2004	350
Low-Solids Coatings	SCAQMD Rule 1113, 2004	120*

*Note: VOC levels for Low-Solids Coatings are measured in grams of VOC per liter of material

For a comprehensive list of USGBC LEED09-NC/CI/CS acceptable products please click the link

below that takes you to the LEED® Green & VOC Coatings Reference Guide.

swgreenspecs.com

Interior Topcoat Paints GS-11 VOC content limits:
Per GS-11 May 20th, 1993 The calculation of VOC shall exclude water and tinting color added at the point of sale.

Coating Type	VOC weight in grams/liter of product minus water
Non-flat	150
Flat	50

2.5 ACCESSORIES

A Coating Application Accessories:
1 Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufactures specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A Do not begin application of coatings until substrates have been properly prepared. Notify Architect of unsatisfactory conditions before proceeding.

B If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C Proceed with work only after conditions have been corrected and approved by all parties, otherwis e application of coatings will be considered as an acceptance of surface conditions.

3.2 SURFACE PREPARATION

A Proper product selection, surface preparation, and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and
implementation of proper surface preparation ensures coating adhesion to the substrate and prolongs the service life of the coating system.

B Selection of the proper method of surface preparation depends on the substrate, the environment, and the expected service life of the coating system. Economics, surface contamination, and the effect on the
substrate will also influence the selection of surface preparation methods.

C The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

D Remove mildew before painting by washing with a solution of one (1) part liquid household bleach and three (3) parts of warm water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes; however, do not allow the solution to dry on the surface. Rinse
thoroughly with clean water and allow the surface to dry 48 hours before painting. Wea r protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the

bleach/water solution.

E No painting should take place when the interior temperature is below 50°F unless the specified product is designed for the marginal conditions.

F Methods

1 Aluminum
Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.

2 Block (Cinder and Concrete)
Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and
mortar must be cured at least 30 days at 75°F unless the manufactures products are designed for application prior to the 30-day period. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.

3 Concrete, SSPC-SP13 or NACE 6
This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-
place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

4 Cement Composition Siding/Panels
Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.

5 Drywall—Interior
Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.

6 Galvanized Metal
Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and
oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.

7 Plaster
Must be allowed to dry thoroughly for at least 30 days before painting, unless the manufactures products are designed for application prior to the 30-day period. Room must be ventilated while drying; in cold, damp weather, rooms must be heated. Damaged areas must be repaired with an appropriate patching material. Bare plaster must be cured

and hard. Textured, soft, porous, or powdery plaster should be treated with a solution of 1-pint household vinegar to 1 gallon of water. Repeat until the surface is hard, rinse with clear water and allow to dry.

8 Steel: Structural, Plate, etc.
Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.

9 Solvent Cleaning, SSPC-SP1
Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill s cale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.

10 Hand Tool Cleaning, SSPC-SP2
Hand Tool Cleaning removes all loos e mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the metho ds outlined in SSPC-SP1 or other agreed upon methods

11 Power Tool Cleaning, SSPC-SP3
Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be remo ved by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1 or other agreed upon methods.

12 Commercial Blast Cleaning, SSPC-SP6 or NACE 3
A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent (33%) of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by
stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC -SP1 or other agreed upon methods.

13 Power Tool Cleaning to Bare Metal, SSPC-SP11
Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC -SP1, Solvent Cleaning, or other agreed upon methods.

14 Water Blasting, NACE Standard RP-01-72
Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.

15 Vinyl Siding, Clean the surface thoroughly by scrubbing with warm, soapy water. Rinse thoroughly. Do not paint vinyl siding with any color darker than the o riginal color, unless the product and color are designed for such use. Painting with darker colors may cause the

siding to warp.

16 Wood

Must be clean and dry. Prime and paint as soon as possible. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

WARNING! Removal of old paint by sanding, scraping or other means may generate dust or fumes that contain lead. Exposure to lead dust or fumes may cause brain damage or
other adverse health effects, especially in children or pregnant women. Controlling exposure to lead or other hazardous substances requires the use of proper protective equipment, such as a properly fitted respirator (NIOSH approved) and proper containment and cleanup.
For more information, call the National Lead Information Center at 1-800-424-LEAD (in US) or contact your local health authority.

3.3 INSTALLATION

A Apply all coatings and materials with manufacturer specifications in mind. Mix and thin coatings according to manufacturer's recommendation.

B Do not apply to wet or damp surfaces.
1 Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days.
2 Test new concrete for moisture content.

C Apply coatings using methods recommended by manufacturer.

D Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

E Apply coatings at spreading rate required to achieve the manufacturer's recommended dry film thickness.

F Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G Inspection: The coated surface must be inspected and approved by the Architect or Engineer just prior to each coat.

3.4 PROTECTION

A Protect finished coatings from damage until completion of project.

B Touch-up damaged coatings after substantial completion, following manufacture's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION

SECTION 10 11 16

MARKERBOARD AND TACKBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Framed markerboards and tackboards.

B. Related Requirements:
1. Section 06 10 00 - Rough Carpentry; wood grounds.
2. Section 09 77 00 - Dry Erase Wall Cover; markerwalls.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Reflectivity: Not to exceed specified range when tested at 60 degrees with a gloss meter in accordance with ASTM C 523.
2. Contrast for marker boards (Light and Dark Effects): not more than 11.7 when tested with a BYK- Gardner Wave Scan 5+ Measurement Device showing visual acuity to the human eye at distances greater than 10 feet.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

B. Product Data: Include complete manufacturer's catalog cuts and data sheets of anchors, fasteners, color chips (photographic reproductions are not acceptable) and installation requirements.

C. Shop Drawings:
1. Include types of units provided, location within each room, and length of each unit.
2. Include dimensioned elevation drawings of each board assembly indicating joint locations and type of joint where required, and board mounting distances from floors.
3. Include cross-section details showing each type of product and components; trim, face, core, backing materials and thickness, and key to elevations.
4. Show anchorage details.
5. Show installation details.

D. Samples: Submit a 12" x 12" sample of each type of markerboard and tackboard. Submit a 6" long sample of each component of exposed trim.

E. Quality Control Submittals:
1. Test Reports: Copies of test reports, from certified testing agency, verifying that products have been tested and meet the specified performance requirements.

F. LEED Submittals:
1. Product Data: For installation adhesives, indicating VOC content.
2. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low- emitting materials.
3. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

4. For adhesives and composite wood products, indicating that product contains no urea formaldehyde.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

B. Maintenance Data: Include data on regular cleaning, and stain removal.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/smoke rating for vinyl fabric covered tackboards in accordance with ASTM E 84.

B. BYK-Gardner Wavescan 5+

C. Porcelain Enamel Institute (PEI): PEI-1002, Manual and Performance Specifications for Porcelain Enamel Writing Surfaces (Whiteboards).

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 WARRANTY

A. Assembled Units: Manufacturer’s standard 1-year warranty against defects in materials and workmanship.

B. Special Warranty for Porcelain-enamel Face Sheets: Manufacturer’s standard Life-of-the-building warranty in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship. Failures include, but are not limited to: 1) Surface lose original writing and erasing qualities;
2) Surfaces become slick or shiny; 3) Surfaces exhibit crazing, cracking, or flaking.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

B. Liquid Chalk Type Board (MB): Provide projectable porcelain enamel steel liquid chalk writing system, 4'-0" width by length indicated. Product/ manufacturer; one of the following:
   LCS^3 White Board; Claridge Products and Equipment, Inc.
   Porcelain on Steel Markerboards; Platinum Visual Systems™; a division of abc School Equipment
   1. Face sheet of 24 gage leveled enameling steel with porcelain enamel writing surface.
   2. Core material of nominal 1/2" thick fiberboard or double-ply hardboard.
   3. Panel backing of 0.015" sheet aluminum or 26 gage sheet steel.
   4. Manufacturer shall factory assemble and bond together the face sheet, core and backing sheet.
   5. Colors shall be as selected by Architect.
   6. Markerboard panel shall be up to 16'-0" in length without joints.
   7. Provide music staffed boards where indicated.
      a. Staffing shall be fused 1/8" lines, 1" center to center, 5 spaces between staffs, both G and F clefs.
      b. Colors as selected by Architect.

C. Framed Tackboard (TB):Provide vinyl covered tackboards in configuration as shown Product/ manufacturer; one of the following:
   Fabricork Vinyl Bulletin Boards; Claridge Products and Equipment, Inc.
   Vinyl Corkboard; Platinum Visual Systems™; a division of abc School Equipment
   1. Heavy-duty, self-healing vinyl machine laminated under high pressure to 1/4" thick cork.
   2. Rigid backing panel of 1/4" hardboard.
   3. Cork and backing panel shall be factory assembled and bonded together.
   4. Colors shall be as selected by Architect.
   5. Tackboards shall be up to 16'-0" in lengths without joints.

D. Framed Pegboard: 1/4" natural hardboard with 9/32" dia. holes on 1" centers. Provide board in configuration as shown.

E. Frames and Trim: Provide extruded aluminum frames and trim. Finish for exposed trim surfaces shall be Architectural Class II AA-M21A31 natural anodic coating. Snap-on type trim is not acceptable. Product/manufacturer; one of the following:
   Series 185; Claridge Products and Equipment, Inc.
   HTS; Platinum Visual Systems™; a division of abc School Equipment

F. Joint Strips: H-shaped aluminum in single pieces for full height of boards.
   1. At vertical joints within markerboards, color the strips to match the markerboards.
   2. At vertical joints between markerboards and tackboards, strips shall be anodized aluminum.

G. Map Rails: 1" wide of extruded aluminum with cork insert and Claridge No. 51ES type end stops. Furnish one No. 51M metal map hook for each linear foot of map rail and two No. 51FH flag holders for each room with map rails. Finish map rail to match the markerboard frames."

H. Chalktroughs: Heavy tubular type of extruded aluminum with cast aluminum end caps, finished to match the markerboard frames.

I. Adhesive:
   1. Adhesives shall have a VOC content of 50 g/L or less.
   2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   3. Flash-proof type furnished or recommended by the manufacturer.

2.2 AVAILABLE SIZES

1. Standard panel thickness: 1/2".
2. Maximum dimensions: 16' length x 4' height.
3. Common sizes: 2'x3', 3'x4', 4'x6', 4'x8', 4'x12', 4'x16'.

2.3 **PRODUCT SELECTION**

1. 10 11 01.MB10 MARKERBOARD – Claridge series 1 – flat tray – Type C, LCS porcelain No. 100 white, 4'-0" x 10'-0" markerboard with side tackboard panels on each side. Field verify whether both tackboard fit in each case.

2. 10 11 01.MB8 MARKERBOARD – Claridge series 1 – flat tray – Type C, LCS porcelain no. 100 white, 4'-0" x 8'-0" markerboard with side tackboard panels on each side. Field verify whether both tackboard fit in each case.

3. 10 11 00.TB TACKBOARD - Claridge series 1 – Type C, with Claridge Cork 4'-0" X 4'-0" tackboard panels on each side in the color No. 1103 OYSTER.

Trim Detail

Tray Options

Flat Tray

Type C

2.4 FABRICATION

A. Fabricating Boards: Markerboards and tackboards shall be factory framed units up to 16'-0" one piece in length. Boards too large to be factory framed shall be assembled on the job to match the factory-built boards.
   1. Assemble frames with hairline joints. Corner joints shall be mitered. There shall be no exposed face fasteners of any sort.
   2. Make up boards in single sheets without joints where possible. Where vertical joints are necessary, space them symmetrically and use joint strips to cover them. Horizontal joints are not acceptable.
   3. Vertical joints between markerboard and tackboard in the same frame shall be covered with single mullion trim pieces. Double mullions at these joints will not be acceptable.
   4. Provide a map rail across the top of each markerboard unit.
   5. Provide a chalktrough under each markerboard unit.
   6. Manufacturer's labels shall not be exposed to view.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Verify surfaces to receive units are true and plumb. Report unsuitable conditions to the responsible contractor for correction prior to installation.
   2. Verify moisture and temperature levels of substrate and environment have stabilized.

3.2 INSTALLATION

A. Erecting Framed Units: Install framed markerboards and tackboards in conformance with the manufacturer's instructions using continuous wall hangers and adjustable mounting clip angles.
   1. On masonry walls, secure the hangers with screws into metal expansion shields or with toggle bolts.
   2. On gypsum wallboard partitions, locate the hangers to engage the steel stud flanges where possible and secure with molly bolts or self-drilling fasteners into the studs, or attach to wood blocking with suitable length screws.
   3. On back of markerboards, field install blocking pads at 16" on centers horizontally and vertically. Apply manufacturer's recommended adhesive evenly over entire surface of each pad using a serrated trowel.
   4. Behind the tackboards furnish and field install suitable blocking pads 16" o.c. each way to prevent bowing.
   5. Behind pegboards, field install blocking pads at 16" on centers.
   6. The installed boards shall be flat, plumb, square and rigid.
   7. Mounting Height: From finished floor to bottom of chalkrail or bottom of tackboard shall be: Kindergarten / Pre-Kindergarten - 24"
      Elementary - 30"
      Adult-only Locations - 36"

3.3 CLEANING

A. Remove crates, cartons and rubbish from the premises and leave the room broom clean. Clean down board surfaces to leave them in perfect condition.
B. Remove all debris post-installation and ensure surfaces are in pristine condition.
C. Use manufacturer-recommended cleaning methods.

END OF SECTION

SECTION 10 12 00

DISPLAY CASES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Display cases.

B. Related Sections:
   1. Division 26 - Electrical; rough-in for light fixture.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include installation instructions.

B. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit a 12" square sample of tackboard material and a 12" length of trim.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide 390 Series display cases as manufactured by Claridge, Inc.. Provide manufacturer's optional fully- recessed fluorescent light fixtures. Equivalent products of one of the following will be acceptable:
   A-1 Visual Systems
   Nelson-Harkins
   Industries Poblocki
   Sign Company

2.2 MATERIALS

A. Aluminum Extrusions: Provide manufacturer's standard extruded aluminum sections of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5 alloy.

B. Glass: Provide clear, tempered safety glass complying with the requirements of ASTM C 1048, Type I, Kind FT, Condition A, Class 1 - transparent.

C. Tackboard: Provide seamless sheet, 1/4" thick ground natural cork compressed with a resinous binder with washable vinyl finish and integral color throughout, laminated to burlap backing. Provide color and texture as selected by Architect.

D. Fasteners: Provide screws, bolts, and other exposed fastening devices of the same material as the items being fastened. Use theft-proof fasteners.

E. Glazed Sliding Doors: 3/16" thick tempered glass, framed, with extruded aluminum frame; supported on ball-bearing rollers.
   1. Lock: Furnish each cover with the manufacturer's standard lock; key all locks alike. Furnish 2 keys per lock.

2.3 FABRICATION

A. General: Fabricate display cases to comply with dimensions, design, and details, and quality indicated.

B. Fabricate perimeter and cover frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

C. Hardware for Covers: Equip covers with the manufacturer's standard hardware of the type indicated.

D. Provide the manufacturer's standard recessed display cases, fabricated to sizes indicated, consisting of the display case housing with perimeter frame, sides and back, tackable surface, and operable transparent covers with hardware.

E. Perimeter Frame and Cover Design: Provide extruded aluminum perimeter frame of profile indicated. Provide extruded aluminum door frame of the profile indicated, glazed with 3/16" thick clear tempered glass.

F. Finish: Class II, Clear Anodic Finish, AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units plumb, and level, in locations shown. Securely attach to the supporting structure with concealed fasteners, in accordance with the manufacturer's installation instructions.

3.2 CLEANING AND PROTECTION

A. Upon completion of installation, clean surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Architect.

END OF SECTION

SECTION 10 14 00

IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cast aluminum letters, room identification signs, and building dedication plaque.

B. Related Sections:
   1. Section 01 21 00 - Allowances.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Submit manufacturer's complete line of color samples, 1" x 3", for initial color selection.

C. Invoices: Submit certified copies of invoices indicating description and quantity of signs delivered and installed.

D. Template: Submit full-size template drawing for approval of aluminum letter size, stock, spacing, anchorage devices, etc.

1.3 PRE-INSTALLATION CONFERENCE

A. Pre-installation Meeting: Contractor shall schedule a pre-installation meeting at the project site with the Architect, Contractor and building letter installer for approval of template field layout prior to beginning of installation.

1.4 QUALITY ASSURANCE

A. Interior signs shall be provided by a single source with at least five years' experience successfully providing signs of similar type and scope.

B. Signs shall comply with the Texas Accessibility Standards (TAS) and other laws and ordinances of authorities having jurisdiction. Braille shall be Grade II, having dimensions as required to meet TAS.

1.5 PACKING, DELIVERY, AND STORAGE

A. Deliver components correctly packaged to prevent damage.Pack modules and back-up plates unassembled to allow for mechanical mounting of backplate to wall with concealed fasteners.

B. Individually and clearly identify each sign number, type, location to be installed, mounting instructions, and other pertinent information.

PART 2 - PRODUCTS

2.1 CAST ALUMINUM LETTERS

A. Provide cast aluminum letters as selected by Architect as shown in drawings. Basis of Design

Manufacturer is Takeform

i. Sizes as indicated on drawings
ii. Font shall be “Bank Gothic” to match adjacent lettering on main building
iii. Color shall be Anodized Aluminum on Metal Panel Substrates, Dark Brown painted on EIFS substrates.

2.2 CAST ALUMINUM LOGO SIGNAGE

A. Provide cast aluminum Logo Signage as selected by Architect as shown in drawings. Basis of Design Manufacturer is Takeform.

i. Logo as shown in drawings, finish should be Anodized Aluminum

2.3 EXTERIOR IDENTIFICATION SIGNAGE

A. Provide room identification signs as selected by Architect. Basis of Design Manufacturer is Takeform

i. Post Mount Identification/Wayfinding signage. Contractor shall coordinate with Owner for Wayfinding, and provide at a minimum, ADA Parking, Exit Only, Fire Lane, No Parking, No Smoking, safety signage in project scope whether shown or not on drawings. Coordinate with Architect for exact locations.

2.4 INTERIOR IDENTIFICATION SIGNAGE

A. Provide room identification signs as selected by Architect. Basis of Design Manufacturer is Takeform

i. Wall Mount Room/Identification Signage
ii. Flag Room/Identification Signage
iii. Coordinate with architect for exact locations and with owner for Room Names and Numbering prior to ordering.

2.5 INTERIOR IDENTIFICATION WINDOW GRAPHICS

A. Provide room identification signs as selected by Architect. Basis of Design Manufacturer is Takeform

i. Vinyl Graphics on Interior Nanawall assemblies as part of Wayfinding concept. Provide shop drawings for approval by Owner and Architect.

2.6 BUILDING DEDICATION PLAQUE

A. Provide building dedication plaque as selected by Architect in Vestibule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Erecting Letters: Erect letters straight and level on the exterior face of building where shown.
   1. Attached to face brick: Secure with threaded stud anchors set in non-staining, quick setting cement. Letters shall be flush mounted to masonry surfaces.
   2. Attached to building canopy: Secure letters to aluminum canopy structure with stainless steel threaded rods and self-locking nuts. Letters shall be flush mounted with threaded rods deformed to prevent sign removal from canopy.
   3. Attached to CMU wall: Secure letters to CMU wall with stainless steel threaded rods and non-staining, quick setting cement. Letters shall be flush mounted to masonry surfaces.

B. Identification Graphics:
   1. On hard surfaces (i.e. ceramic tile, masonry, or plastic laminate), install room identification signs plumb and square with the "Tuff-bond" silicone adhesive furnished by the manufacturer (foam tape is not allowed).
   2. On painted gypsum wallboard or vinyl wallcovering, install room identification signs on backing plates with the "Tuff-bond" silicone adhesive furnished by the manufacturer (foam tape is not allowed).
      a. The backing plate shall be 1/8" thick and shall be the same size as the face panel.
      b. Screw the backing panel into molly bolts in the wall with two countersunk, flathead screws.
   3. Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.
   4. Unless noted otherwise, install signs on latch side of the door such that clear floor space of 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
   5. Installation shall comply with ADA requirements.
   6. For signs mounted on glass, install matching coverplate on opposite side of glass and aligned with the sign.
   7. Install pressure sensitive vinyl letters plumb and square in strict compliance with manufacturer's instructions.

C. Building Dedication Plaque: Install building dedication plaque plumb and square in strict compliance with manufacturer's instructions.

3.2 CLEANING

A. On completion, clean exposed surfaces and leave free of defects.

B. Do not use abrasives.

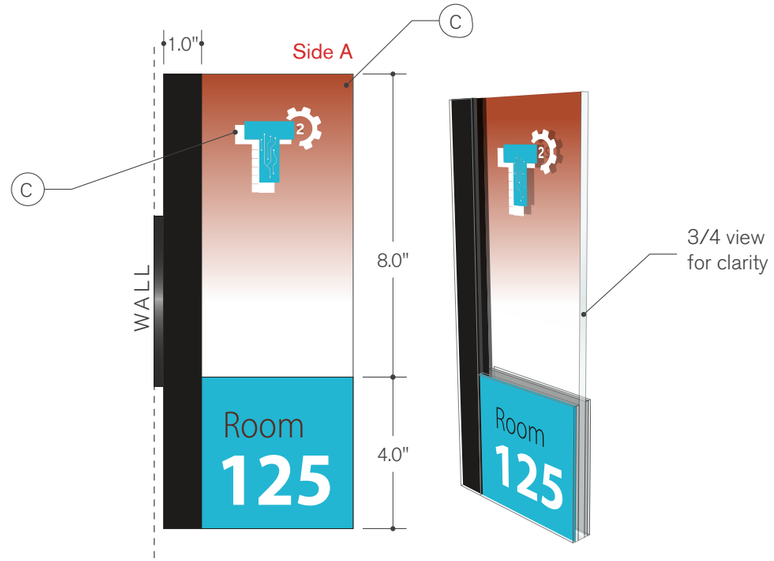
3.3 COORDINATION

A. Contractor shall coordinate the installation of the identifying devices with other trades involved in the project.

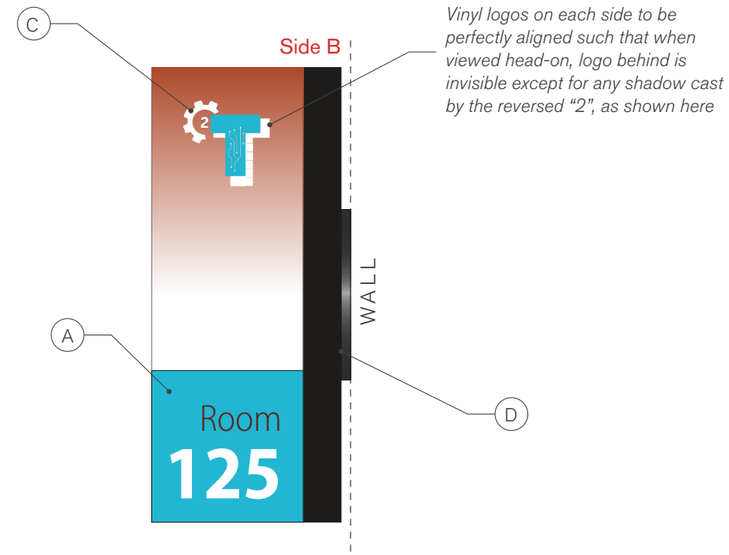
3.4 DAMAGE

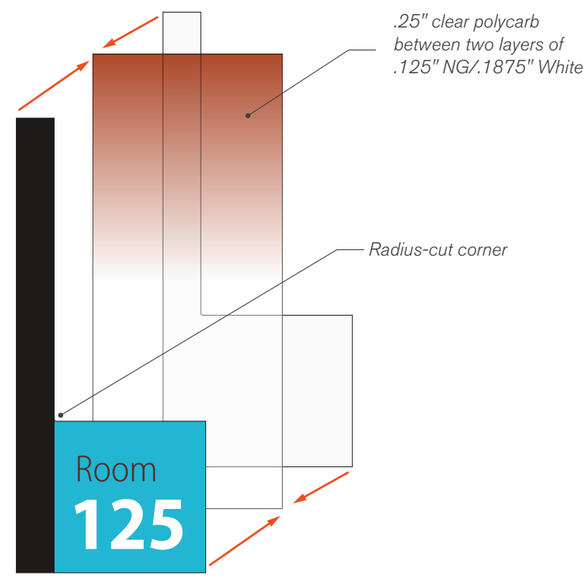
A. An identifying device which is scratched or defaced will be rejected.

END OF SECTION



Type M Custom
5.0"w X 12.0"h + Mount
Double Sided





Direct Print Background
(A) .125"NG/.1875 White, contour-cut as shown;
Print to match Black, White, Blue (**Client to supply PMS #**)

.25" Clear Polycarbonate *(Type M only)*
(B) Printed gradient, one side only;
Gradient: Rust from 100% to 0% opacity, no spot layer;
Client to supply Rust PMS #

Vinyl (BOTH SIDES of NG Acrylic)
(C) Finish: Matte White, printed to match Blue (**Client to supply PMS #**)
Artwork: **Client to supply vector artwork;**
NOTE: Logo is **mirrored** on Side B except for the **number 2**, which must be legible both sides;
Cut: Face

Metal Accent
(D) Black

takeform
11601 Maple Ridge Rd, Medina, NY, 14103
P 800.528.1398 F 585.798.8889
www.takeform.net

Rendering

Project:
SENMC Trade x Technologies Vocational Building

Date: 03.12.25
Drawn By: NAK

Filename:
SOU0203_227491_RND_Rev2

Design Review By:
DRG,NEG (clear poly flag) 03.26.25

Revisions:
03.25.25NAK two sign families; WF opts
04.04.25NAK elim opts

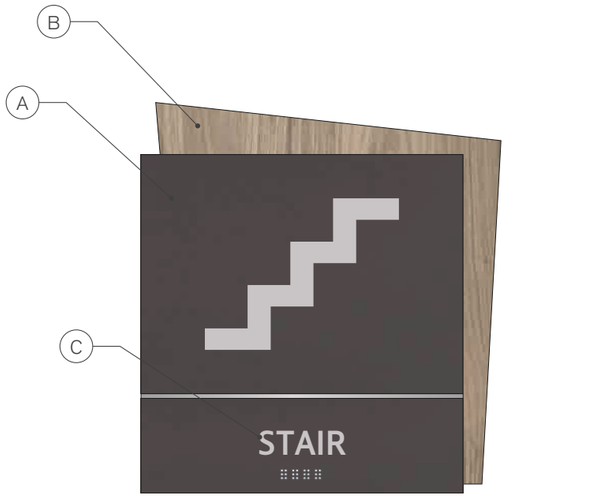
NOT Production Ready

Scale: 3" = 1'

Notes:
Sign copy shown is for sample purposes only

Window Backer if required:
- Fusion w/o Backer: To match Face
- Fusion w/Deco. Acrylic Backer: To match Face
- Fusion w/Backer: To match Backer
- Metal lam: Closest Matching Metallic Appliqué
- Vivid: White Appliqué

Product Approval
☐ As Is ☐ As Noted
Approved By: _____
Date: _____



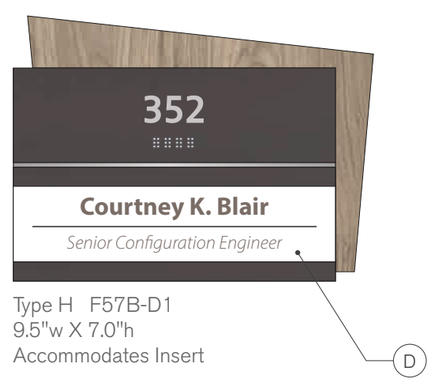
Type E F57B-G2-BC
9.5"w X 10.5"h

Type G F57B-BH
9.5"w X 4.0"h

Type J.2 F57B-D2S
9.5"w X 9.25"h

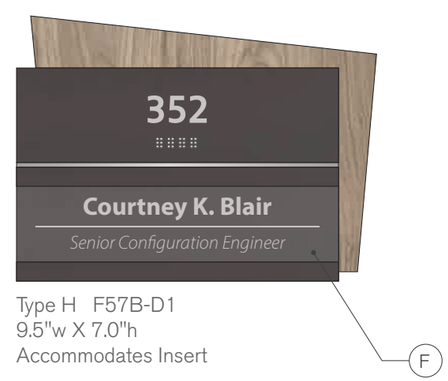
Type E.2 F57B-G2-BC
9.5"w X 10.5"h

Option 1



Type H F57B-D1
9.5"w X 7.0"h
Accommodates Insert

Option 2



Type H F57B-D1
9.5"w X 7.0"h
Accommodates Insert

BRN

Face Finish
(A) **500-00033** Touch-Me-Not

Backer Finish
(B) **500-00025** Acadia

Raised Copy
(C) **CO103** Dove;
Font: Bernina (ADA)

Insert
(D) Media: White Polyester;
Font: Myriad Pro Bold, Light Italic;
Graphics/Copy Color: Owl Gray

Metal Accent
(E) Natural

Insert
(F) Media: Clear Polycarbonate;
Font: Myriad Pro Bold, Light Italic;
Graphics/Copy Color: Dove

takeform
11601 Maple Ridge Rd, Medina, NY, 14103
P 800.528.1398 F 585.798.8889
www.takeform.net

Rendering

Project:
SENMC Trade x Technologies Vocational Building

Date: 03.12.25
Drawn By: NAK

Filename:
SOU0203_227491_RND_Rev2

Design Review By:
DRG,NEG (clear poly flag) 03.26.25

Revisions:
03.25.25NAK two sign families; WF opts
04.04.25NAK elim opts

NOT Production Ready

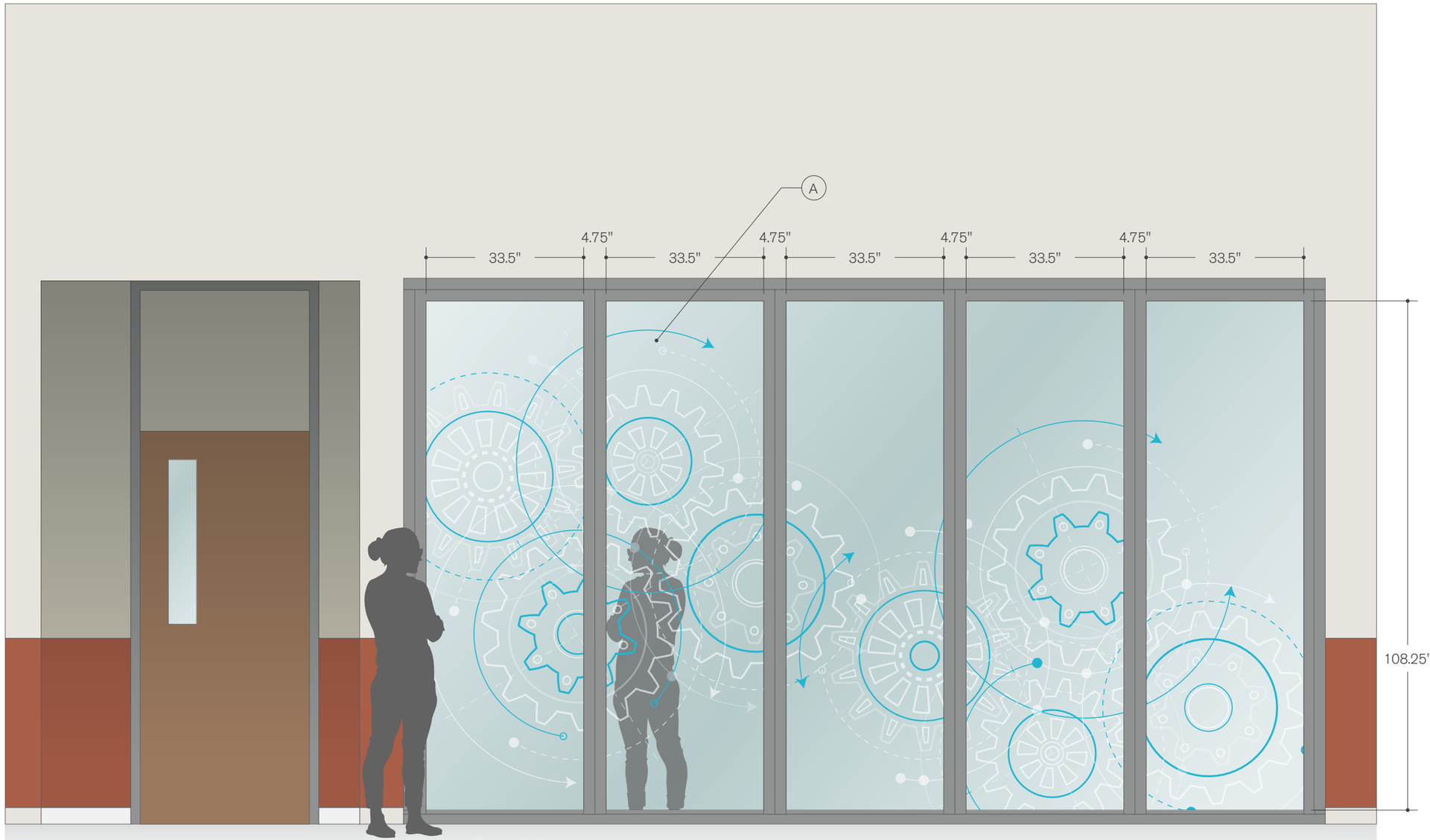
Scale: 3" = 1'

Fusion™ | 57

Notes:
Sign copy shown is for sample purposes only

Window Backer if required:
- Fusion w/o Backer: To match Face
- Fusion w/Deco. Acrylic Backer: To match Face
- Fusion w/Backer: To match Backer
- Metal lam: Closest Matching Metallic Appliqué
- Vivid: White Appliqué

Product Approval
☐ As Is ☐ As Noted
Approved By: _____
Date: _____



Type WF.Gears
Size: **TBD** wide X 108.25"h

Client Note: Field verification required prior to production

Amplify Window Film

☐ (A) **WF-102** Clarity; *Optically Clear Window Film*
Artwork: Use artwork shown (White + Blue (**Client to supply PMS #**));
Cut: Reverse
Full Coverage;
White Spot Layer: 100% behind all Blues; Whites vary in opacity as shown.
Applicable for indoor use, outdoor only
when laminated with UV protective coating.
Maximum usable film width 57"

takeform
11601 Maple Ridge Rd, Medina, NY, 14103
P 800.528.1398 F 585.798.8889
www.takeform.net

Rendering

Project:
SENMC Trade x Technologies Vocational Building

Date: 03.12.25
Drawn By: NAK

Filename:
SOU0203_227491_RND_Rev2

Design Review By:
DRG,NEG (clear poly flag) 03.26.25

Revisions:
03.25.25NAK two sign families; WF opts
04.04.25NAK elim opts

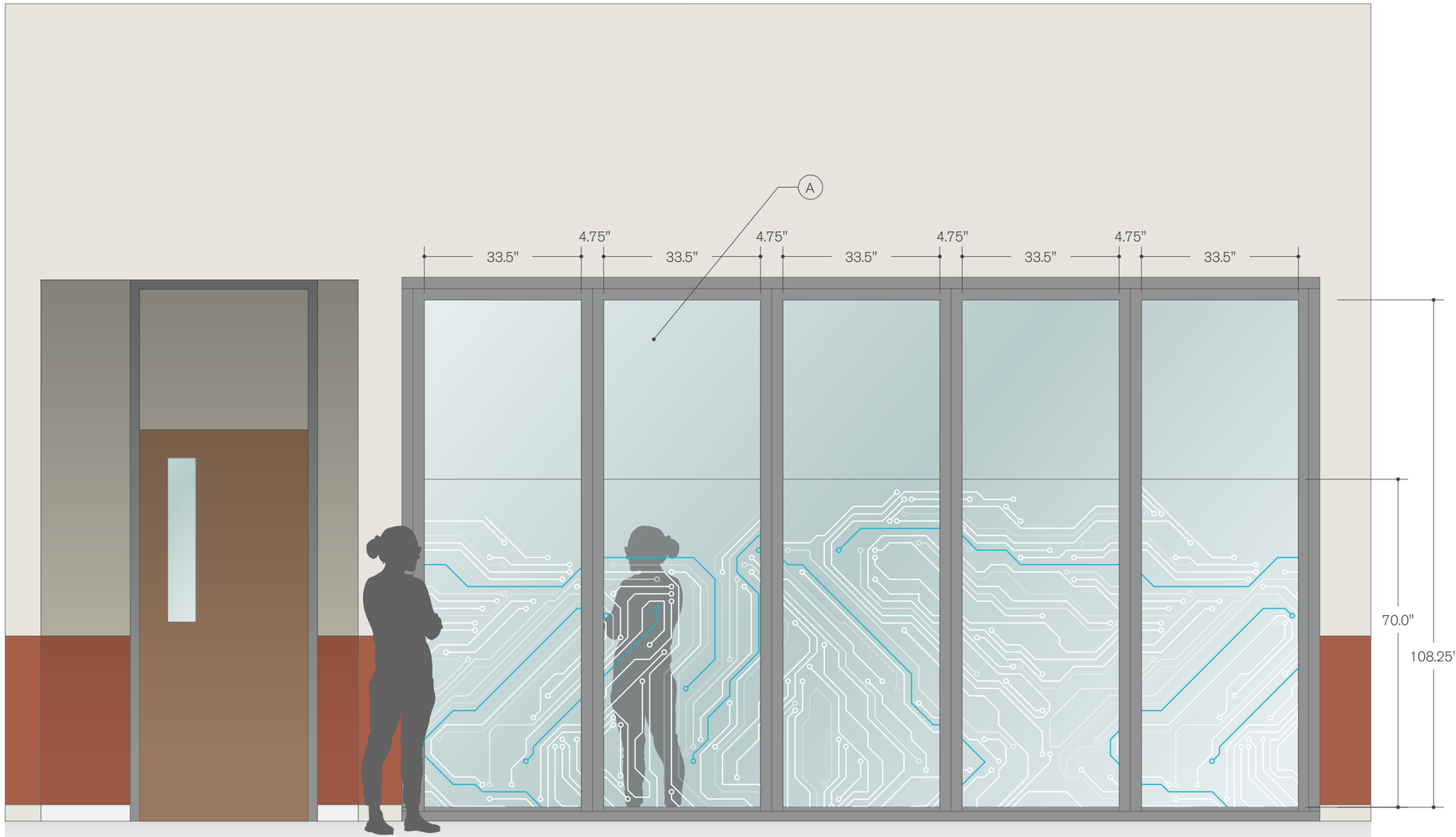
NOT Production Ready

Scale: ½" = 1'

Amplify
WALLCOVERINGS & WINDOW FILMS

Notes:
- Material seams are adjoined during installation; edge to edge (butt) or overlapped – depending on finish.
- Finishes noted as removable are only so in a specific time period; see specs on our website.

Product Approval
☐ As Is ☐ As Noted
Approved By: _____
Date: _____



Type WF.Circuits
Size: **TBD** wide X 70.0"h

Client Note: Field verification required prior to production

Amplify Window Film

☐ (A) **WF-102** Clarity; *Optically Clear Window Film*
Artwork: Use artwork shown (White + Blue (**Client to supply PMS #**));
Cut: Reverse
Full Coverage;
White Spot Layer: 100% behind all Blues; Whites vary in opacity as shown.
Applicable for indoor use, outdoor only
when laminated with UV protective coating.
Maximum usable film width 57"

takeform
11601 Maple Ridge Rd, Medina, NY, 14103
P 800.528.1398 F 585.798.8889
www.takeform.net

Rendering

Project:
SENMC Trade x Technologies Vocational Building

Date: 03.12.25
Drawn By: NAK

Filename:
SOU0203_227491_RND_Rev2

Design Review By:
DRG,NEG (clear poly flag) 03.26.25

Revisions:
03.25.25NAK two sign families; WF opts
04.04.25NAK elim opts

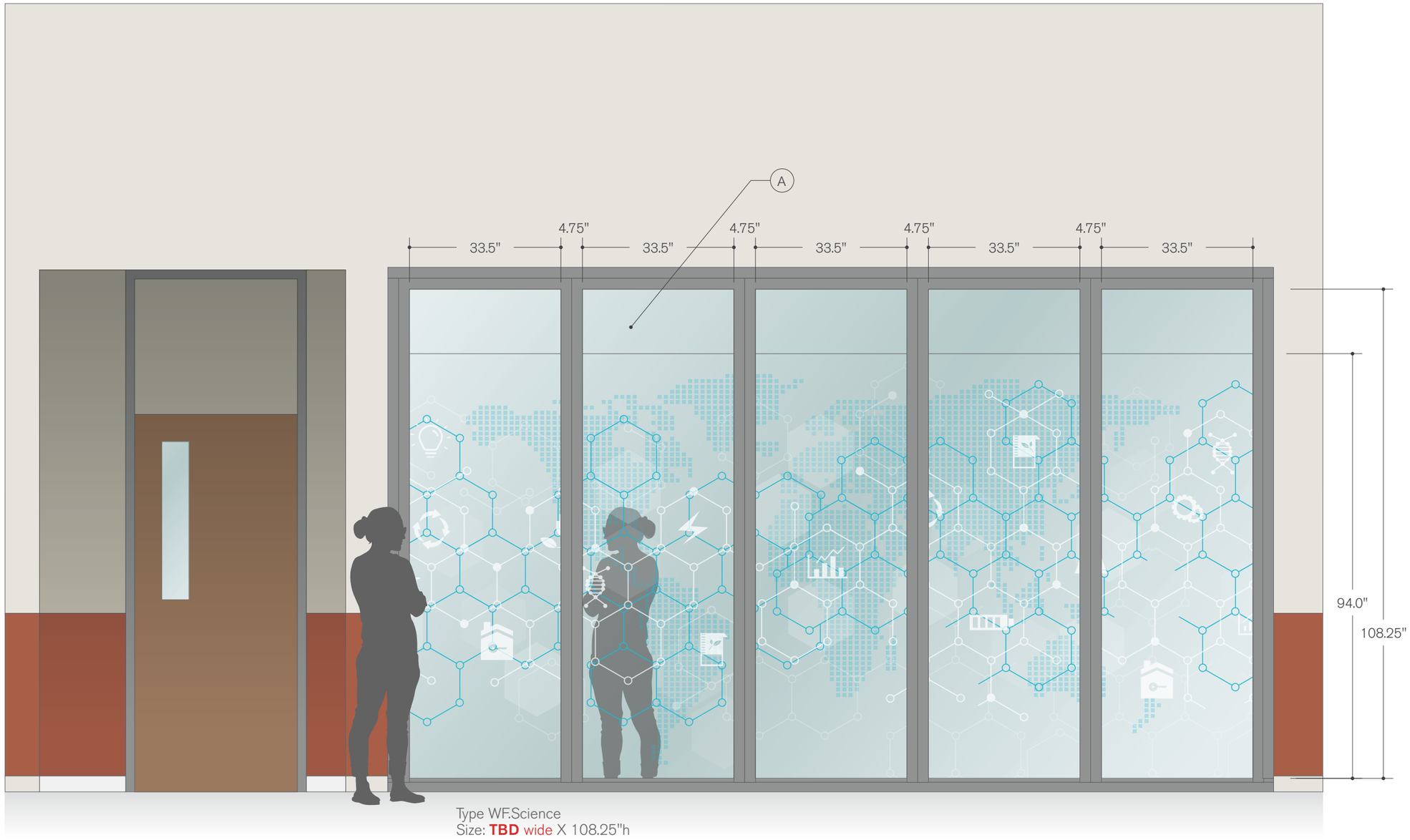
NOT Production Ready

Scale: ½" = 1'

Amplify
WALLCOVERINGS & WINDOW FILMS

Notes:
- Material seams are adjoined during installation; edge to edge (butt) or overlapped – depending on finish.
- Finishes noted as removable are only so in a specific time period; see specs on our website.

Product Approval
☐ As Is ☐ As Noted
Approved By: _____
Date: _____



Client Note: Field verification required prior to production

Amplify Window Film

☐ (A) **WF-102** Clarity; *Optically Clear Window Film*
Artwork: Use artwork shown (White + Blue (**Client to supply PMS #**));
Cut: Reverse
Full Coverage;
White Spot Layer: 100% behind all 100%-opacity Blues; Whites vary in opacity as shown.
Applicable for indoor use, outdoor only
when laminated with UV protective coating.
Maximum usable film width 57"

takeform
11601 Maple Ridge Rd, Medina, NY, 14103
P 800.528.1398 F 585.798.8889
www.takeform.net

Rendering

Project:
SENMC Trade x Technologies Vocational Building

Date: 03.12.25
Drawn By: NAK

Filename:
SOU0203_227491_RND_Rev2

Design Review By:
DRG,NEG (clear poly flag) 03.26.25

Revisions:
03.25.25NAK two sign families; WF opts
04.04.25NAK elim opts

NOT Production Ready

Scale: ½" = 1'

Amplify
WALLCOVERINGS & WINDOW FILMS

Notes:
- Material seams are adjoined during installation; edge to edge (butt) or overlapped – depending on finish.
- Finishes noted as removable are only so in a specific time period; see specs on our website.

Product Approval
☐ As Is ☐ As Noted
Approved By: _____
Date: _____

SECTION 10 21 13

METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal toilet compartments and urinal screens.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry: wood blocking for bracket attachments.
2. Section 10 28 00 - Toilet Accessories.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
1. Include complete manufacturer's catalog cuts and data sheets of hardware, anchors, fasteners, and installation requirements.
2. Submit literature documenting that the partition door latch meets Texas Accessibility Standards (TAS) requirements.

C. Shop Drawings: Include drawings for fabrication and erection of toilet compartment assemblies which are not fully described in manufacturer's data.

D. Samples: Submit color chips (photographic reproductions of color are not acceptable) of each color selected.

1.3 SEQUENCING AND SCHEDULING

A. Coordinate work with placement of suspension members and anchorage devices. Supply rough-in data in sufficient time for concealed preparatory to be conducted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Provide floor-mounted, overhead-braced toilet compartments. Product/manufacturer; one of the following: Accurate Partitions Corp. (an ASI Group Company)
Global Partitions (an ASI Group Company)
Corinthian; Metpar Corp.

C. Urinal Screens; Product/manufacturer; one of the following:
Type A with one additional wall bracket; Accurate Partitions Division (an ASI Group Company) WH; Global Partitions (an ASI Group Company)
Type WH; Metpar Corp.
Type C with one additional wall bracket; The Sanymetal Products Co., Inc.

2.2 MATERIALS

A. Steel Sheets for Baked Enamel Finish: ASTM A 591, Class C, galvanized-bonderized of the

following minimum thicknesses:
1. Pilasters and Panels: 20 - 22 gage.
2. Doors: 22 gage.
3. Concealed Reinforcement for Anchorages: 12 gage.
4. Concealed Reinforcement for Taping: 14 gage.

B. Core: Cellular honeycomb of Kraft paper with a double faced Kraft liner.

C. Pilaster Shoes: ASTM A 167, Type 302/304 stainless steel of one-piece construction, 3" high, finish to match hardware.

D. Headrails: Extruded, polished anodized aluminum in anti-grip profile.

2.3 FABRICATION

A. Fabricate doors and compartment panels 1" thick and pilasters 1¼" thick of two pan-formed steel sheets assembled over and cemented to rigid core. Seal the formed edges with continuous oval-crown locking strips which are mitered, welded and dressed smooth at corners.

B. Fabricate flush compartment panels, pilasters, and doors to the layout indicated with the following minimum dimensions:
1. Where grab bars are indicated, provide a min. 32" wide (clear opening) door.
2. At other locations, standard compartments shall have a 24" wide in-swinging door, unless specifically detailed and dimensioned otherwise.
3. Doors and compartment panels shall be 58" in length with a 12" clearance between floor and bottom of panels and doors. Pilasters shall be floor mounted, overhead braced, 82" high.
4. Urinal screens 18" by 42" high.

C. Hardware: Provide hardware and fittings for compartment system of chrome-plated cast non-ferrous metal alloy, chrome-plated brass, or polished stainless steel. Stirrup brackets only may be heat-treated extruded aluminum with bright anodized finish.
1. Hinges: Continuous hinges (self closing).
2. Brackets: Full height continuous type.
3. Latches: Fully mortised concealed type with steel bolt and provision for emergency access and paddle handle on accessible stalls.
4. Strikes and Keepers: Wrap-around type with rubber bumper, mounted with through bolts.
5. Coat hooks with rubber bumpers for in-swinging doors.
6. Pulls: Provide pulls adjacent to the latch on both sides of the toilet partition door. Furnish with wall bumpers where required to prevent doors from striking wall.
7. Fasteners: Vandal proof (one-way) screws and sex bolts of chrome-plated brass or stainless steel for all exposed locations.

D. Finish: Finish steel parts with a baked on primer and synthetic enamel in colors as selected by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Check areas scheduled to receive partitions for correct dimensions, plumbness of walls, soundness of wall surfaces, location of built-in framing/anchorages/bracing, and other conditions that would affect proper installation of holding brackets and anchorage or suspension devices.

C. Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.

3.2 INSTALLATION

A. Install compartments rigid, straight, plumb, and with horizontal lines level. Drilling, cutting, and fitting to room finish shall be concealed in the finished work. Clearance at vertical edges of doors shall be uniform from top to bottom, and doors shall be free of warp and wind. Provide clearances of not more than ½" between pilasters and panels, and not more than 1" between panels and walls.
   1. Attach dividing compartments to the back wall with two heavy two-eared stirrup brackets, and at the front to the pilasters with two of the same type brackets. Use two one-eared brackets at corners. The use of U-type brackets is not acceptable.
   2. Attach overhead braces to walls with heavy saddle-type brackets**.**
   3. Attach pilasters to floor with ⅜" threaded studs, washers, lock nuts, expansion shields (minimum of 2" penetration into concrete), and pilaster brackets. Level, plumb, and tighten the installation with the leveling device. Conceal the floor anchorage and bases with pilaster shoe assembly having concealed snap-down action on a concealed hold-down clip. Exposed fasteners on shoe will not be permitted.
   4. Provide a 12" clearance between floor and bottom of compartment panels and doors.
   5. Attach urinal screens to the wall with continuous brackets. The use of U-type brackets is not acceptable.

3.3 ADJUST AND CLEAN

A. Adjusting: Adjust hardware just prior to final acceptance. Doors shall operate freely.
   1. For out-swinging doors, adjust hinges to hold doors closed.
   2. For in-swinging doors, adjust hinges to hold doors open at 30°.

B. Cleaning: Remove protective masking and clean surfaces, leaving them free of soil and imperfections. Field touch-up of scratches or defaced enamel finish will be permitted only if approved by the Architect.

END OF SECTION

SECTION 10 22 39

FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Electrically operated, continuously hinged partition.

B. Related Work:
1. Section 05 50 00 - Metal Fabrications: Steel framing to support partition track.
2. Section 06 10 00 - Rough Carpentry: Wood blocking for partition track.
3. Section 09 72 16 - Vinyl Wall Coverings.
4. Division 26 - Electrical, electrical rough-in.

1.2 SUBMITTALS

A. Shop Drawings:
1. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Submit shop drawings of partition layout. Include details of track, trolleys, and hardware. Indicate loading to be imposed in the supporting structure. Show all anchorage, accessory items, caulking, and finishes.

B. Product Data:
1. Submit data describing partition fabrication and installation, including hardware.
2. Submit finish data.
3. Submit laboratory acoustical performance test report, written by the test facility.

1.3 QUALITY ASSURANCE

A. Flame Spread Rating: Provide partitions with a Class "A" flame-spread rating when tested in accordance with ASTM E 84.

1.4 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects for a period of two (2) years

PART 2 - PRODUCTS

2.1 PARTITIONS

A. Type: Modernfold "Acoustic-Seal" continuously hinged #933E electrically operated, flat panels, top supported with operable floor seals.

B. Partition shall be operated by two control stations wired in series and located on opposite sides of the partition. Drive motor shall be equipped with limit switches to prevent over-extension and shall have an adjustable clutch type overload device. A positive chain drive attached to the lead panel shall pull the partition across the opening. Cable, belt or other friction type drives will not be acceptable.
1. Electrical motor shall consist of: 120-volt, 1-phase, 1-horsepower, 60 hertz motor.

C. Sound Transmission Class (STC): STC rating shall be 50 when tested in accordance with ASTM E 90 for test in 14'-0" x 9'-0" opening.

D. Panel Construction:
   1. Panels shall be nominal 3" thick.
   2. Panel Skin: Minimum 21 ga. roll-formed steel wrapping around the panel edge. Panel skins shall be lockformed and welded directly to the frame for unitized construction.
   3. Panel Finish: Vinyl wall covering as selected by Architect from wall coverings as specified in Section 09 72 16 - VINYL-COATED FABRIC WALL COVERING.

E. Hinges for Panels shall be full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

F. Sound Seals:
   1. Vertical: Interlocking sound seals in each panel edge.
   2. Horizontal:
      a. Top closure seals shall be continuous multi-finger vinyl.
      b. Provide automatic operable bottom seal. Seal shall automatically drop as panels are positioned.

G. Provide #14 Suspension System
   1. Suspension Tracks: Minimum 7-gage, 0.18-inch roll-formed steel. Static loading of track with brackets at 48-inch centers shall show no failure of track or brackets at 5,000 pounds point loading at mid-span. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 1/2-inch diameter threaded rods. Brackets must support the load bearing surface of the track.
      a. Exposed track soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners, and pre-painted off-white.
   2. Carriers: All-steel trolleys with steel tired ball bearing wheels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Partitions shall be installed by the manufacturer's authorized factory trained representative and shall achieve the specified sound rating.
   1. Secure ceiling tracks to steel framing.
   2. Erect the partitions in a substantial manner to be straight and plumb.

3.2 ADJUST AND CLEAN

A. Adjust partitions and hardware, and leave in perfect working order. Clean exposed surfaces and leave free of defects.

END OF SECTION

SECTION 10 22 39.13

FOLDING GLASS-PANEL

PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sliding/folding aluminum and glass door system, including aluminum frame, threshold, panels, sliding/folding and locking hardware, weather stripping for sound, glass and glazing; designed to provide an opening glass wall, with sizes and configurations as shown on drawings and specified herein.

B. Related Sections:
   1. Section 08 71 00 - Door Hardware.

1.2 SUBMITTALS

A. Detail Drawings: Indicate dimensioning, direction of swing, configuration, swing panels, typical head jamb, side jambs and sill details, type of glazing material, and handle height.

B. Product Data: Manufacturer's literature including independently tested data listing performance criteria and Owner's Manual with installation instructions.

C. Contract Closeout Submittal: Submit Owner's Manual from manufacturer. Identify with project name, location and completion date, type and size of unit installed.

1.3 QUALITY ASSURANCE

A. Manufacturer: Provide complete, precision built, engineered, pre-fitted unit by a single source manufacturer with at least 15 years' experience in providing folding/sliding door systems for large openings in the North American market.
   1. The manufacturer must have a quality system registration to the ISO9001:2000 standard.

B. Performance Requirements: Provide from manufacturer that has independently tested typical units. Testing results to include air infiltration in accordance with ASTM E 283, water penetration in accordance with ASTM E 331/E 547, structural loading in accordance with ASTM E 330, and forced entry in accordance with AAMA 1303.5 and CAWM 300-96.

C. Thermal Performance U value: Unit to be simulated in accordance with NFRC 100, shown in manufacturer's latest published data for the specified product.

D. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar products for large openings. Installer to provide reference list of at least 3 projects of similar scale and complexity successfully completed in the last 3 years.

1.4 WARRANTY

A. Provide manufacturer's standard warranty against defects in materials and workmanship.

B. Warranty Period: Ten years for rollers and for seal failure of insulated glass supplied. For all other components, two years from date of delivery by manufacturer. Unit shall be installed by manufacturer's certified trained installer.

1.5 SITE CONDITIONS, DELIVERY, STORAGE AND HANDLING

A. In addition to general delivery, storage and handling requirements specified in Section 01 6600, comply with the following:
   1. Deliver materials to job site in sealed, unopened cartons or crates. Protect units from damage. Store material under cover, protected from weather and construction activities.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide Nanawall® SL45, Monumental Aluminum Framed Folding/Paired Panel System as supplied by NANA WALL SYSTEMS, INC., 707 Redwood Hwy, Mill Valley, California 94941, Toll Free: (800) 873-5673, Telephone: (415) 383-3148, Website: www.nanawall.com.

2.2 MATERIALS

A. Frame and Panels: From manufacturer's standard profiles, provide head track, side jambs, and panels with dimensions shown on drawings.
   1. Provide panels with horizontal mullion(s) at specified height(s) from the bottom of the panel.
   2. Provide standard bottom rail.
   3. Aluminum Extrusion: Extrusions with nominal thickness of .078" (2.0 mm). Alloy specified as AlMgSi0.5 with strength rated as 6063-T5 or F-22 (European standard). Anodized conforming to AAMA 611.
   4. Aluminum Finish: clear anodized.

B. Glass: All glass to comply with safety glazing requirements of ANSI Z97.1 and CPSC 16CFR 1201. Provide manufacturer's standard glass with dry glazing: 1/4" (6 mm) laminated.

C. Locking Hardware and Handles:
   1. Main entry panel: On the main entry panel for models with a swing panel, provide manufacturer's stainless steel lever handles in a brushed satin finish on the inside and outside. Provide lock core per SECTION 08 71 00 - DOOR HARDWARE, for a compatible lock set with lockable latch, multi-point locking with a dead bolt and rods at the top and bottom on primary panel only. Rods to be concealed and not edge mounted. Depression of handles withdraws latch. Lifting of handles engages rods and turn of key or thumb turn engages deadbolt and operates lock. If there is a secondary swing panel, provide two point locking with flat handles on inside only for the secondary swing panel.
   2. On all other pairs of folding panels, provide manufacturer's standard flat handles and concealed two point locking hardware operated by 180 degree turn of handle between each pair. Face applied flush bolt locking will not be allowed.
   3. Flat handle finish: stainless steel in a brushed satin finish.
   4. Provide handle height centered at 41 3/8" from bottom of panel.
   5. Aluminum locking rods with standard fiber glass reinforced polyamide end caps at top and bottom. Rods to have a stroke of 15/16".

D. Sliding/Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top and bottom tracks.
   1. For each pair of folding panels, provide cardanic, independently suspended, four wheeled coated with fiber glass reinforced polyamide upper running carriage and lower guide carriage.
   2. Provide manufacturer's stainless steel hinges. Provide stainless steel security hinge pins with set screws.
   3. Adjustment: Provide system capable of specified amount of adjustments without removing panels from tracks without needing to remove panels from tracks, 1/16" (1.5 mm) in width per hinge.

E. Other Components:
   1. Threshold: Provide clear anodized flush sill.
   2. Weather stripping: Provide manufacturer's standard double layer EPDM or brush seals with a two layer polyamide fin at both the inner and outer edge of door panels or on frame for

sealing between panels and between panel and frame.

3. Provide stainless steel screws for connecting frame components.

2.3 FABRICATION

A. Use extruded aluminum frame and panel profiles, corner connectors and hinges, sliding and folding hardware, locking hardware and handles, glass and glazing and weather stripping as specified herein to make a folding glass wall. Factory pre-assemble as is standard for manufacturer and ship with all components and installation instructions.

B. Sizes and Configurations: See drawings for selected custom dimensions within maximum frame sizes possible as indicated in manufacturer's literature. See drawings for selected number of panels and configuration. Inward one left, six right.

PART 3 - EXECUTION

3.1 ERECTION

A. Because of the large dimensions involved and the weight and movement of the panels, verify the structural integrity of the header such that the deflection with the live and dead loads is limited to the lesser of L/720 of the span and 1/4". Structural support for lateral loads (both wind load and eccentric load when the panels are stacked open) must be provided.

B. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square, with no unevenness, bowing, or bumps on floor.

C. Installation of units constitutes acceptance of existing conditions.

3.2 INSTALLATION

A. Install frame in accordance with manufacturer's recommendations and installation instructions. Properly flash and waterproof around the perimeter of the opening.

B. Installer to provide appropriate anchorage devices and to securely and rigidly fit frame in place, absolutely level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work.

C. Install panels, handles and lock set in accordance with manufacturer's recommendations and installation instructions.

D. If necessary, adjust hardware for proper operation.

END OF SECTION

SECTION 10 26 13

CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Corner guards.

B. Related Sections:
1. Section 09 21 16 - Gypsum Board Assemblies: gypsum board walls.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

PART 2 - PRODUCTS

2.1 CORNER GUARDS

A. Provide at gypsum board corners without tile or metal panel wainscot. Provide ACROVYN VA-200N by Construction Specialties (800.233.8493, www.c-sgroup.com). Surface mounted guards consisting of factory-applied self- adhesive surface mount tape. Length as indicated on drawings. Color to be selected by Architect from manufacturer's full color range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer’s recommendations, using only approved adhesive and locating all components firmly into position.

B. Install true and plumb.

3.2 PROTECTION AND CLEANING

A. Protect surfaces from damage during construction.

B. At completion of the installation, clean all surfaces.

END OF SECTION

SECTION 10 28 00

TOILET

ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Toilet accessories.

B. Related Sections:
1. Section 08 80 00 - Glazing: un-framed mirrors.
2. Section 10 21 13 - Metal Toilet Compartments.

1.2 SUBMITTALS

A. Product Data:
1. Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
3. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

1.3 QUALITY ASSURANCE

A. Products: Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same area.
1. Stamped names or labels on exposed faces of units will not be permitted.
2. Provide locks where specified, with the same keying for all accessory units in the project.

1.4 COORDINATION

A. Accessibility Standards: Coordinate accessory locations with other work to prevent interference with clearances required for access under ANSI Accessibility Standards (ANSI A117.1 - 2017) and all New Mexico Amendments.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Toilet accessories shall be of the quality manufactured by Bobrick Washroom Equipment, Inc. and are listed by Bobrick catalog numbers for convenience in identification. The use of a catalog number as a description of an item shall be taken to include the description or specification for the item in the manufacturer's catalog.

B. Toilet Accessories: Equivalent items of the following manufacturers are acceptable: American Specialties, Inc.
Bradley Corp.
General Accessory Manufacturing Co. (GAMCO)
McKinney/Parker Washroom Accessories Corp.

2.2 BASIC MATERIALS

A. Stainless Steel: ASTM A 666, Type 304 with No. 4 satin finish.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30 castings.

C. Sheet Steel: ASTM A 1008, cold rolled, commercial quality.

D. Galvanized Steel Sheet: ASTM A 653, G60 (Z180).

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electro-deposited on base metal.

F. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q3, nominal 1/4" thick, with silvering, electroplated copper coating, and protective organic coating complying with ASTM C 1036.

G. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

I. Keys: Provide universal keys for access to accessories for servicing and resupplying. Provide minimum of six keys.

2.3 ACCESSORIES

A. Toilet Tissue Dispensers (A): Owner-Provided, Contractor-Installed.

B. Grab Bars (B and C): Model B-6806, lengths as indicated on drawings.

C. Mirrors (D and L): Model B-290 2436.

D. Paper Towel Dispenser/Waste Receptacles (EA): Owner-Provided, Contractor-Installed.

E. Sanitary Napkin Disposal Units (F): Model B-270.

F. Soap Dispensers (G): Owner-Provided, Contractor-Installed.

G. Custodian's Utility Shelves (J): Model B-224 x 36", one per Custodian's Closet and where scheduled.

H. Mop and Broom Holders (L): Model B-223 x 36.

I. Robe Hooks (M): Model B-211.

J. Folding Shower Benches: Model B-5181.

K. Shower Curtain Rods: Model B-6107, with 204-3 shower curtain for 37" to 60" openings, on 204-1 curtain hooks.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions and recommendations, using fasteners appropriate to substrate and recommended by manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated. Adhesive mountings and plastic rawl plug mounts will not be acceptable.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square.

C. At toilets with wheelchair compartments all toilet accessories shall be installed so that operating areas such as coin slots, pushbuttons, openings for towels, cups and waste are not more than 48" above finished floor for frontal approach.

D. Attach dispensers and cabinets to steel stud partitions with suitable hollow wall screw anchors. Attach dispensers and cabinets to masonry partitions with stainless steel expansion shields and machine screws.

E. Attach sanitary napkin disposal units and toilet tissue dispensers to toilet partition panels with stainless steel or chrome plated through bolts and hex cap nuts.

F. Install grab bars to withstand a downward load of at least 250 lbf. Attach grab bars to toilet partition panels with stainless steel through bolts and plated hex cap nuts. Attach grab bars to steel stud partitions with connector assemblies to steel anchors fastened to studs. Attach grab bars to masonry partitions with stainless steel expansion shields and machine screws.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer’s written recommendations.

END OF SECTION

SECTION 102801
WASTE AND RECYCLING RECEPTACLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Waste receptacles.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: Busch Systems International Inc.: www.buschsystems.com

B. Other Acceptable Manufacturers: American Specialties, Inc:www.americanspecialties.com/#sle.
   1. Products by listed manufacturers are subject to compliance with specified requirements found in specification and in Technical Data Sheet of selected model and prior approval of Architect.

C. Substitutions: See Section 016000 - Product Requirements.
   1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect minimum of 10 working days prior to bid date and must be made available to all bidders. Proposed substitutes must be accompanied by review of specification and Technical Data Sheets noting compliance on line-by-line basis.

2.02 WASTE RECEPTACLES

A. Waste Receptacle: Stainless steel, freestanding style with swing top.
   1. Liner: Removable seamless stainless steel receptacle.
   2. Liner: Removable heavy-duty vinyl liner, attached at a minimum of four points with stainless steel grommets and hooks.
   3. Minimum Capacity: As indicated in product listing.

2.03 PRODUCTS:

a. Mezzo™ Series Waste Receptacles (Busch Systems): INTERIOR
   - Available in double and triple configurations.
   - Powder-coated steel body with multiple lid configurations (Hinged Lid, Multi-Hinged Lid).
   - Stock body colors: White, Black (Black Triple available with minimum order quantity).
   - Lid color options: Black, Blue, Green.
   - Available labeling and signage customization options.
   - Dimensions:
     - Double: 30.625”H x 26.875”W x 15”D (30-gallon capacity).
     - Triple: 30.625”H x 39.8125”W x 15”D (45-gallon capacity).

b. Barco Products – Round Slat Design Receptacle: EXTERIOR
   - 32 Gallons, Wood grain naturals in the color Walnut (SKU KTR2020W-TK)

c. Substitutions: Section 016000 - Product Requirements.

2.04 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Body: Powder-coated steel, steel construction

C. Lids: Powder-coated steel.

D. Labels: 3M High Tack Vinyl with Glossy Resin Coating.

2.05 ENVIRONMENTAL CONSIDERATIONS

A. All Mezzo™ Series receptacles use a low-energy, resource-efficient manufacturing and curing process.

B. All components are recyclable at the end of life.

C. Manufactured in North America with low or no VOC powder coat finishes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

1. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

3.05 LEAD TIME

A. Standard lead times for the Mezzo™ Series: 1-2 weeks for stock, 6-8 weeks for custom or large orders.

END OF SECTION

SECTION 10 44 13 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fire extinguishers and fire extinguisher cabinets.

1.2 DEFINITIONS

A. Where indicated on the drawings the abbreviation "F.E.C." defines a fire extinguisher and cabinet and the abbreviation "F.E." is for fire extinguisher without cabinet.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include physical dimensions, operational features, color and finish, anchorage details, material descriptions and type of hardware.

C. Shop Drawings: Include rough-in measurements, locations, and details for cabinets.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain products in this Section from one manufacturer.

B. Certifications
   1. Provide extinguishers which are U.L. listed and bear the U.L. "Listing Work" for type, rating, and classification.
   2. Conform to NFPA-10 requirements for extinguishers.
   3. Provide units conforming with ANSI/UL 711.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Store extinguishers in protected location until after final cleaning is completed.

1.7 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Do not store products subject to freeze damage in environments where damage could occur.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Provide multi-purpose dry chemical type fire extinguisher, 10 lbs. nominal capacity. Provide manufacturer's standard hook type bracket where fire extinguishers are noted without cabinets. Product/manufacturer; one of the following:
   Cosmic 10E; J.L. Industries, Div. of Activar, Inc.
   MP10; Larsen's Manufacturing Co.
   Wing 10HB; Modern Metal Products
   Model 3010; Potter-Roemer

B. At Kitchen provide wet chemical type fire extinguisher with a Class K UL rating. Provide manufacturer's standard wall mounting bracket. Product/manufacturer; one of the following:
   Saturn 15 Model, JL Industries, Inc., Div. of Activar,
   Inc. WC-6L Series Wet Chemical, Larsen's
   Manufacturing Co. 3260; Potter-Roemer/B260;
   Amerex

2.2 FIRE EXTINGUISHER CABINETS

A. Provide stainless steel trim and door. Doors shall be solid with vertical window and have continuous piano hinge. "Fire Extinguisher" vertical ascending silk-screened lettering in red. Product / manufacturer; one of the following:
   Fire-FX 1037V10 Cosmopolitan; J.L. Industries, Div. of
   Activar, Inc. FS SS2409-R4 Vertical Duo, Acrylic; Larsen's
   Manufacturing Co. "Alta" Series No. 7063-DV-6; Potter-
   Roemer.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for type and capacity of fire extinguisher indicated, with plated or baked-enamel finish. Color shall be red.

B. Identification: Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface. Orientation shall be horizontal.

2.4 FABRICATION

A. Form body of cabinet with tight inside corners and seams.

B. Predrill holes for anchorage.

C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.

D. Hinge doors for 180° opening with continuous piano hinge. Provide nylon roller type catch.

2.5 FINISHES

A. Extinguisher: Red enamel.

B. Cabinet Trim and Door: Stainless Steel.

C. Cabinet Interior: White enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fire extinguisher cabinets at locations indicated in accordance with the manufacturer's instructions. Install level, plumb, secure. Install fire extinguisher cabinets with operable part of extinguisher at 48" above finished floor.

B. Install fire extinguishers within cabinets on mounting brackets, placed in such a manner that operating instructions face outward.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb. Apply identification decals above bracket-mounted fire extinguishers.

D. Service, charge (if required), and tag each fire extinguisher not more than five calendar days prior to substantial completion.

E. Maintain design of fire-rated partitions associated with cabinets.

END OF SECTION

SECTION 10 51 00

LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal lockers.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry; wood sleepers and wood blocking.
2. Section 09 65 00 - Resilient Flooring; rubber base.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit complete manufacturer's catalog cuts and data sheets of hardware, anchors, fasteners and installation requirements.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show base, sloping tops, filler panels and other accessories. Include locker identification system.

D. Samples: Submit color chips (photographic reproductions of color are not acceptable).

E. LEED Submittals:
1. Environmental Product Declaration: For each product.
2. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
3. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

1.3 QUALITY ASSURANCE

A. Uniformity: Provide each type of metal locker as produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

B. Store and protect lockers under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

C. Protect locker finishes and adjacent surfaces from damage during

installation. PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General Lockers: Materials and methods described are based on the specifications of **Penco Products, Inc.** (www.pencoproducts.com) and are given to designate the quality of materials and workmanship required. Equivalent lockers as manufactured by one of the following will be acceptable:

Art Metal Products, Div Fort Knox Storage Co.
(www.artmetalproducts.com) List Industries, Inc.
(www.listindustries.com)
Lyon Metal Products, Inc. (www.lyonmetal.com)

2.2 STANDARD LOCKERS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Materials: Sheet metal shall be smooth cold-rolled steel, ASTM A 1008, at least 16 gages for doors and frames and 24 gage for bodies. Nuts and bolts shall be cadmium plated.

C. Construction: Doors shall be louvered at top and bottom, and adequately flanged at edges. Door frames of channel shapes shall be securely welded together. Provide continuous door strikes at jambs. Provide rubber silencers on each latching hook. Fabricate to swing 180°.
   1. Ventilation: Provide stamped, louvered vents in door face, as follows:
      a. Single-tier Lockers: Not less than 6 louver openings top and bottom.
      b. Double-tier Lockers: Not less than 6 louver openings top and bottom.
   2. Hinges: Heavy-duty, not less than 0.050" thick steel, full-loop, 5 knuckle, tight pin, 2" high. Provide at least 3 hinges for each door over 42" high and at least 2 hinges for each door 42" high or less.

D. Locks:
   1. Recessed handle with keyed locks.
   2. Provide handicapped accessible latches on accessible lockers.

E. Trim: 16 gage steel filler strips to cover spaces between lockers and adjacent walls at ends of rows and elsewhere as may be required. Provide finished end panels (no holes) for exposed ends of locker rows. Finish trim to match lockers.

F. Equipment: Furnish each double-tier locker with the following items.
   1. One double prong hook and not less than two single-prong wall hooks.
   2. At handicapped accessible lockers, hat shelf, hooks and handle with locker or hasp must be no higher than 48” from finish floor
   3. At handicapped accessible lockers, locker bottom must be a minimum of 15" from finish floor. If locker bottom is lower than 15” from finish floor, provide internal shelf at a minimum of 15” above finish floor.

G. Continuous Sloping Tops: Not less than 18-gage sheet steel, approximately 25° pitch, in lengths as long as possible. Provide closures at ends. Finish to match exterior of lockers.

H. Finish: Chemically pre-treat metal with degreasing and phosphatizing process. Apply baked-on enamel finish to all surfaces, exposed and concealed, except plates and non-ferrous metal. Colors as scheduled

I. Number Plates: Aluminum with black filled numbers, fastened with rivets to the top of the front face of the locker door, not in the recess. Number lockers consecutively as directed by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases and verify that bases are properly sized and located. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

B. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36" O.C. The use of sheet metal screws for assembly and installation is not allowed.

C. Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

3.3 ADJUST AND CLEAN

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint.

C. Touch-up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

SECTION 10 71 13

EXTERIOR SUN CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum sun control devices.

B. Related Sections:
   1. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data: Include manufacturer's installation instructions and recommendations.

C. Shop Drawings: Submit shop drawings for fabrication and erection of sunshade units and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

D. LEED Submittals:
   1. Energy and Atmosphere: Optimize Energy Performance. Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.
   2. Indoor Environmental Quality Credit: Construction IAQ Management Plan, During Construction. Reduce indoor air quality resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.
   3. Recycled Content: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content. Include a statement indicating costs for each product or assembly having recycled content.

1.3 QUALITY ASSURANCE

A. Comply with SMACNA "Architectural Sheet Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.

B. Field Measurements: Verify size, location and placement of sunshade units prior to fabrication, wherever possible.

C. Shop Assembly: Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, mechanical attachment and field assembly of units. Pre-assemble units to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

D. Mock-Up: Provide a mock-up for evaluation of fabrication workmanship.
   1. Locate on project site as selected by Architect.
   2. Provide units finished as specified.
   3. Mock-up may remain as part of the Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design: Provide cantilevered sunshade system as manufactured by C.R. Laurence Co, Inc., 2503 E. Vernon Ave., Los Angeles, CA 90058-3488; Tel: (800) 421-6144 Ext. 7770 or (323) 588-1281 Ext. 7770;; Email: archmetals@crlaurence.com. Equivalent products of one of the following will be acceptable: Airolite Co.
C/S Group
Dittmer Architectural Aluminum
Industrial Louvers, Inc.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 211, Alloy 6063-T6.

B. Clip Angles: Structural grade aluminum.

C. Fastenings: Fasteners shall be aluminum or stainless steel. Provide types, gauge and lengths to suit unit installation conditions.

D. Anchors and Inserts: Use non-ferrous metal or hot-dip galvanized anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 FABRICATION

A. Construction of Components: Blades to be one piece 6063-T6 extrusions and to be standard louver blade profile. Outriggers and fascia shall be rectangular aluminum tube. All fasteners to be aluminum or stainless steel. Anchorage castings to be high strength aluminum alloy. All anchorage bolts to be stainless steel. Sunshades to be designed by the manufacturer to withstand wind/snow loading of 45 psf.

B. Sunshade and accessories of design, materials, sizes, depth, arrangement and metal thickness as indicated or as required for optimum performance with respect to strength; durability; and uniform appearance.

C. Include supports, anchorages and accessories required for complete assembly.

2.4 ALUMINUM FINISH

A. General: Comply with NAAM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products are assembled. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces which will be visible after completing finishing process.

B. Aluminum Finish: As scheduled on the “Exterior Color Selection” schedule.
1. Exposed aluminum surfaces of entrances, storefronts, frames, doors, and all their associated parts shall be Architectural Class I AA-M12C22A41 Clear Anodic Coating. Screw and bolt heads exposed to view shall be finished to match the exposed aluminum surfaces.
2. Stainless Steel.

C. Finish shall be applied or fabricated in the plant of the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install sun screens in strict compliance with manufacturer's written instructions and recommendations. Locate and place sunshade units plumb, level and in proper alignment with adjacent work.

B. Use concealed anchorages wherever possible.

C. Form tight joints with exposed connections accurately fitted together.

D. Use isolation tape where aluminum comes in contact with steel or concrete masonry units.

END OF SECTION

SECTION 10 99 00

MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Knox Box.

B. Related Sections:
   1. Section 06 10 00 - Rough Carpentry; blocking.
   2. Division 26 - Electrical; connection to Security System.

1.2 SUBMITTALS

A. General: Submit following items in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include complete manufacturer's catalog cuts and data sheets, complete parts list, installation requirements, and all pertinent performance characteristics and criteria.

C. Shop Drawings: Indicate materials, construction, sizes, quantities, finishes, and installation details.

1.3 QUALITY ASSURANCE

A. Products: Provide products of the same manufacturer throughout the project.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Knox Box: Fire/Rapid Entry System as manufactured by The Knox Company.
   1. Model 3200 RTS with 3200 RMK Recessed Mounting Kit.
   2. Model 3200, surface mounted.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrate surfaces as recommended by manufacturer.

3.2 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this Section.

B. Notify Architect of any existing conditions which will adversely affect execution.

C. Beginning of execution will constitute acceptance of existing conditions.

3.3 INSTALLATION

A. Knox Box: Surface Mounted:
   1. Mount the Knox Box unit with the yellow mounting marker pointing up so that the small moisture drain hole is on the bottom side.
   2. Use a small level to plumb the box square.
   3. Use at least 4 mounting fasteners (Carriage Bolts, etc.) of 5/16" diameter, bolting completely through solid, secure wall. The Knox Box unit may also be welded in place. NOTE: Do not mount unit on drywall, plywood, pressboard or any other limited strength materials.
   4. To install door, first attach retaining chain through the hole in the chain tab on the back side of the door and close link with pliers. Door should be inserted bottom side first so that tail piece fits over bottom of door frame. Top of door will now swing shut.

3.4 ADJUSTING

A. Adjust and fit items to be flush with adjacent construction.

B. Fasten or adhere for tight connections and joints.

3.5 PROTECTION

A. Protect the completed work from damage. Replace damaged items which cannot be repaired. Protect finished installation in accordance with SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

3.6 CLEANING

A. Upon completion of the building, clean area. Leave the items free of defects and in ready-to-use condition.

B. Perform final cleaning in accordance with SECTION 01 74 13 - PROGRESS CLEANING.

END OF SECTION

SECTION 11 52 13

PROJECTION

SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Motorized projection screens projection screens.

B. Related Sections:
   1. Section 09 91 00 - Painting
   2. Division 26 - Electrical: electrical rough-in.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include manufacturer's installation instructions.

1.3 WARRANTY

A. Provide manufacturer’s standard two year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design: Electrically Operated Projection Screen, “Magnifica 703200” Room" as manufactured by Recordex USA. Equivalents by Da-Lite Screen Co., Inc. and Draper, Inc. are acceptable
   1. Mounting: Recessed above ceiling.
   2. Motor: 3-wire, instantly reversible, with lifetime lubrication. Motor shall be equipped with internal thermal overload protector; shall be fitted with mechanical brake to eliminate coasting; and shall be mounted on rubber vibration insulators. Entire drive unit shall be removable from case.
   3. Control Switch: Provide 3-position control switch which shall stop or reverse screen at any point in its operating cycle. Controls shall be furnished complete with aluminum box and stainless steel cover plate.
   4. Screen Fabric: Da-Lite or Draper “Matte White”, flame- and mildew-resistant. Provide black border. Provide Black “extra drop” above picture area to:
      a. Multi-Purpose Area: 2'-0" above platform finish floor.
   5. Case: Hardwood finish with primer coat of paint. Motor compartment shall be metal lined.
   6. Viewing Surface: 117” x 156”
   7. Screen shall be listed by

U.L. PART 3 - EXECUTION

3.1 INSTALLATION

A. Install projection screens securely anchored to provide rigid installation. Screen shall be installed in strict accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Certificate: The distributor or manufacturer's representative shall certify in writing to the Owner that the installation, adjustment and performance are in accordance with the

manufacturer's recommendations.

3.3 ADJUST AND CLEAN

A. Adjusting: Carefully adjust and regulate the projection screen after installation.

B. Protection: Protect the completed work from damage. Replace damaged items which cannot be repaired.
C. Cleaning: Upon completion of the building, clean the projection screen. Leave the screen free of defects and in ready-to-use condition.

END OF SECTION

DIVISION 12 – FURNISHINGS

SECTION 12 00 00 – FURNITURE (SEPARATE PRICE)

PART 1 – GENERAL

1.1 SUMMARY
A. This Section includes loose furniture items to be furnished and installed by the Contractor under a separate price from the base bid.
B. Furniture may include, but is not limited to:

1. Desks, tables, and workstations
2. Task and guest seating
3. Conference furniture
4. Lounge and lobby seating
5. Storage cabinets and shelving
6. Lab and specialty furniture (if applicable)

1.2 ALTERNATE / SEPARATE PRICE
A. Provide all labor, materials, delivery, and installation for furniture under a separate line item price.
B. The Owner reserves the right to accept or reject this separate price independent of the base contract.

1.3 SUBMITTALS
A. Product Data: Manufacturer's specifications, dimensions, finishes, and warranty information for each item.
B. Shop Drawings: Layout drawings showing furniture placement and coordination with architectural plans.
C. Samples: Submit finish samples upon request.
D. Installation Schedule: Submit proposed installation schedule coordinated with project milestones.

1.4 DELIVERY, STORAGE, AND HANDLING
A. Store furniture in a dry, clean environment. Protect from damage and theft.
B. Deliver only when installation areas are ready and approved by Owner/Architect.

1.5 WARRANTY
A. Manufacturer's standard warranty, minimum one year.
B. Warranty shall cover defects in materials, workmanship, and installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS
A. Contact BECKTOI for further detail on the Preliminary Furniture package, Pending approval from owner. Contact Jamie Field at (505) 459-5339 or jfield@becktoi.com for further information.

B. Subject to compliance with requirements, provide products by one or more of the following manufacturers or approved equals:

1. Steelcase
2. Herman Miller

3. Haworth
4. Teknion
5. KI
6. Global
7. Other approved manufacturers

C. Additional “Maker Tables” for large labs and PLC Instrumentation Labs shall be purchased from H2i in coordination with the Lab Casework. Contact Dustin Bauer at (303)501 – 9824 or dbauer@h2igroup.com

Custom Mobile Cart

- 1-5/8" Welded Strut Frame (Kumar N-200) Construction
- 16 GA Flat Sheet Metal Shelves at Lower and Upper Levels
- 16 GA Perforated Mesh Partition Panels at Lower Level, dividing the shelf into four compartments
- 16 GA Perforated Hinged Doors at Lower Level, with locking plate
- Perforated panels and doors to include welded U-edging trim where required
- 3" Locking Casters
- **Manufacturer:** Kumar Industries – *No substitutions*

2.2 MATERIALS AND COMPONENTS
A. Frames: Steel or aluminum construction, powder-coated where applicable.
B. Surfaces: High-pressure laminate, wood veneer, or approved composite materials.
C. Upholstery: Commercial-grade fabric or vinyl, stain-resistant and durable.
D. Glides: Adjustable levelers on all freestanding furniture.

2.3 FABRICATION
A. All furniture to be factory-assembled or delivered ready for final on-site assembly.
B. Items to be free from defects, sharp edges, or exposed fasteners.

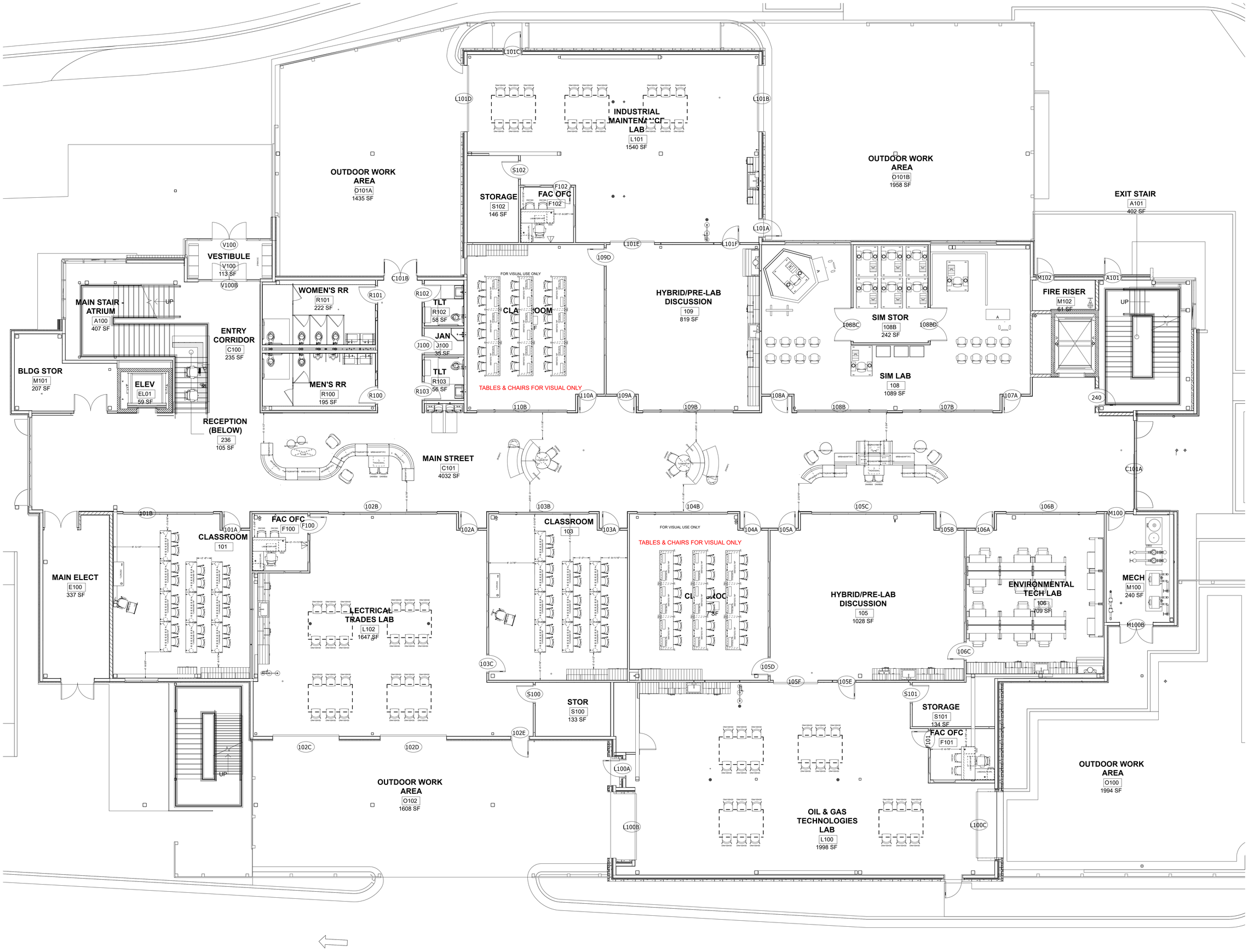
PART 3 – EXECUTION

3.1 INSTALLATION
A. Install furniture per approved layout and manufacturer’s instructions.
B. Verify floor flatness and coordinate with other trades.
C. Anchor or secure furniture where required for safety or code compliance.

3.2 CLEANING
A. Clean all furniture surfaces after installation. Remove packaging and debris from site.

3.3 PROTECTION
A. Protect all installed furniture from damage until final acceptance.
B. Repair or replace any damaged items at no additional cost to the Owner.

3.4 PRELIMINARY FURNITURE LAYOUT AND SELECTIONS (PENDING APPROVAL BY OWNER)



FLOOR PLAN

Scale3/16" = 1'

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON K/'S INTERPRETATION OF BUILDING SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY K/ TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY EXPRESSED OR IMPLIED IN ANY CONTRACT TO WHICH K/ IS A PARTY, K/ DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR K/'S WORK. THIS PLAN MAY NOT BE USED FOR THE PURPOSES OF THE KAME . APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. K/ RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES . K/ DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES. THIS INFORMATION IS PRESUMED AND DEEMED AS RELIABLE . CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF K/ IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EVALUATE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO K/. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EVALUATE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO K/. AUTHORIZED SIGNATURE INDICATES REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED BY K/. OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY K/ IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE: _____

PRINT: _____

PANELS

U1 36W0 — INDICATES THE 'A SIDE' OF PANEL

— INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	RZ-KS	CHANGES PER DOC
2	01/23/2025	RS-KS	CHANGES PER DOC
3	02/06/2025	R4-KS	CHANGES PER DOC/EXEM
4	02/18/2025	RS-KS	CHANGES PER JAIME EM
5	03/11/2025	CK	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

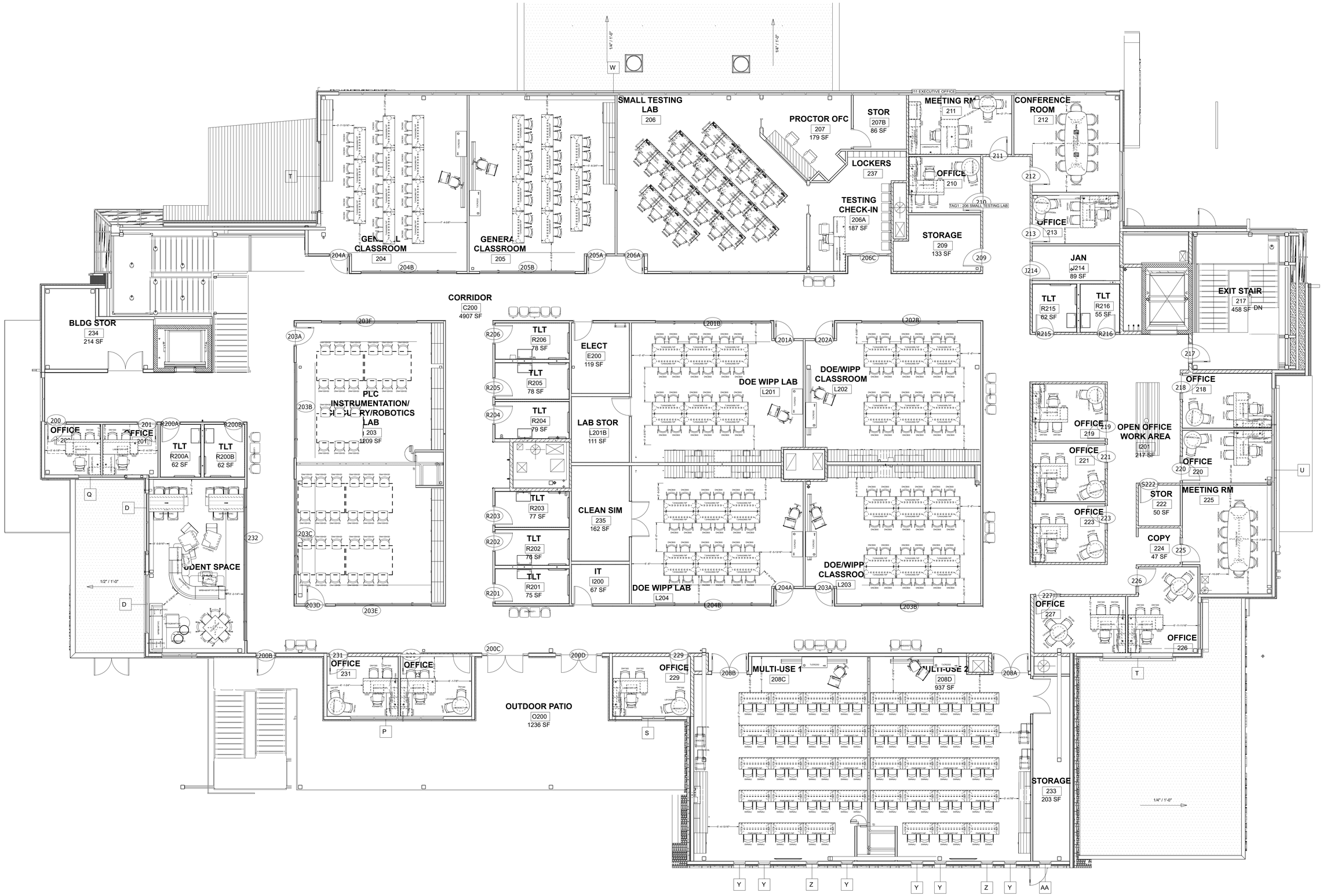
DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:21:45 PM Karinne Stazak

SHEET: 1/41 FLOOR PLAN



Scale3/16" = 1'

FLOOR PLAN

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF THE APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THE PLAN OR ANY OTHER DOCUMENT OR CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK. NOTHING IN THE PLAN SHALL BE DEEMED A WAIVER OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES. THIS INFORMATION IS PRESUMED AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT FABRICATION IN ACCORDANCE WITH THESE PLANS, MARK THE BOX BELOW, EXECUTE AND COMPLETE THE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATES REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED BY KI. OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

U1 3660

INDICATES THE 'A SIDE' OF PANEL

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #:
718801

DATE:
11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCSSEM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	C4	REV PER 311 PDF
6	04/01/2026	R7-KS	REV PER 25.03.27 DOC

DRAWN BY:
KARINNE

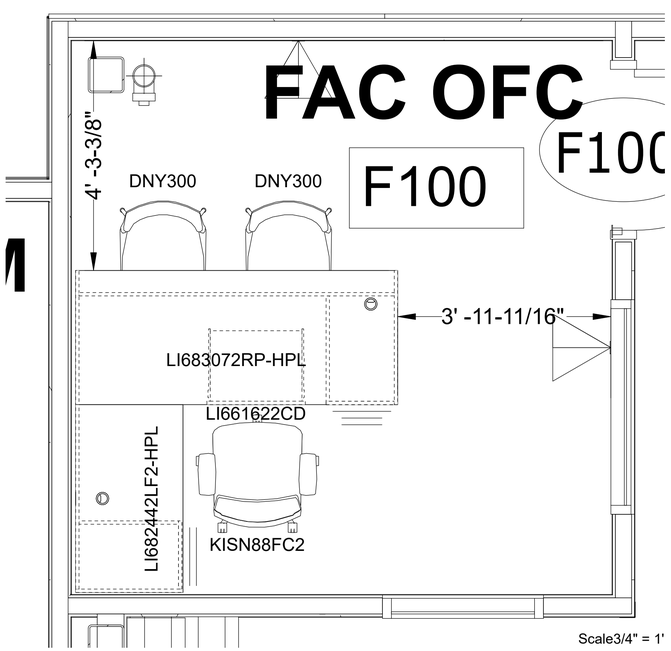
SCALE:
AS NOTED

DRAWING #:
718801_00_00_L07.cmdrw
4/2/2026 3:21:49 PM Karinne Stecak

SHEET: FLOOR PLAN
2/41

#	Quantity	Ind. Tag	Part Number	Options	Description
F100 FACULTY OFFICE					
1	2	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
4	1	LI682442LF2-HPL	LI682442LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,42"Wx24"Dx30"H,HPL
5	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
					Total F100 FACULTY OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

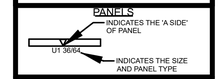
APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/03/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

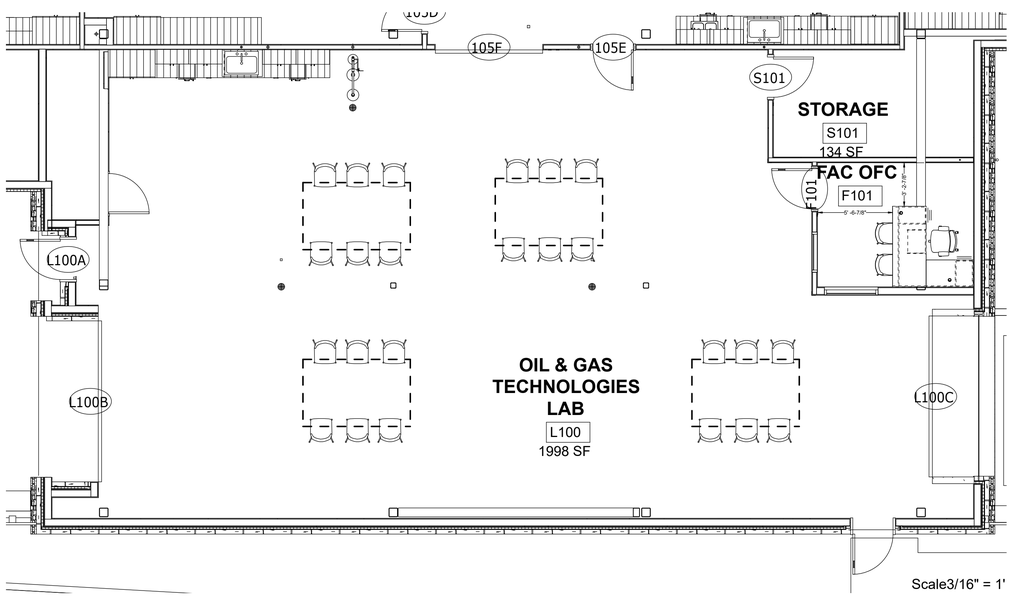
4/2/2025 3:21:51 PM Karinne Skazak

SHEET: 3/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
L100 OIL & GASS TECHNOLOGIES LAB					
1	24	DN4100H30	DN4100H30	/TBD/TBD/TBD	Doni Four-Leg Armless 30" Stool,Poly,Solid Color
					Total L100 OIL & GASS TECHNOLOGIES LAB

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

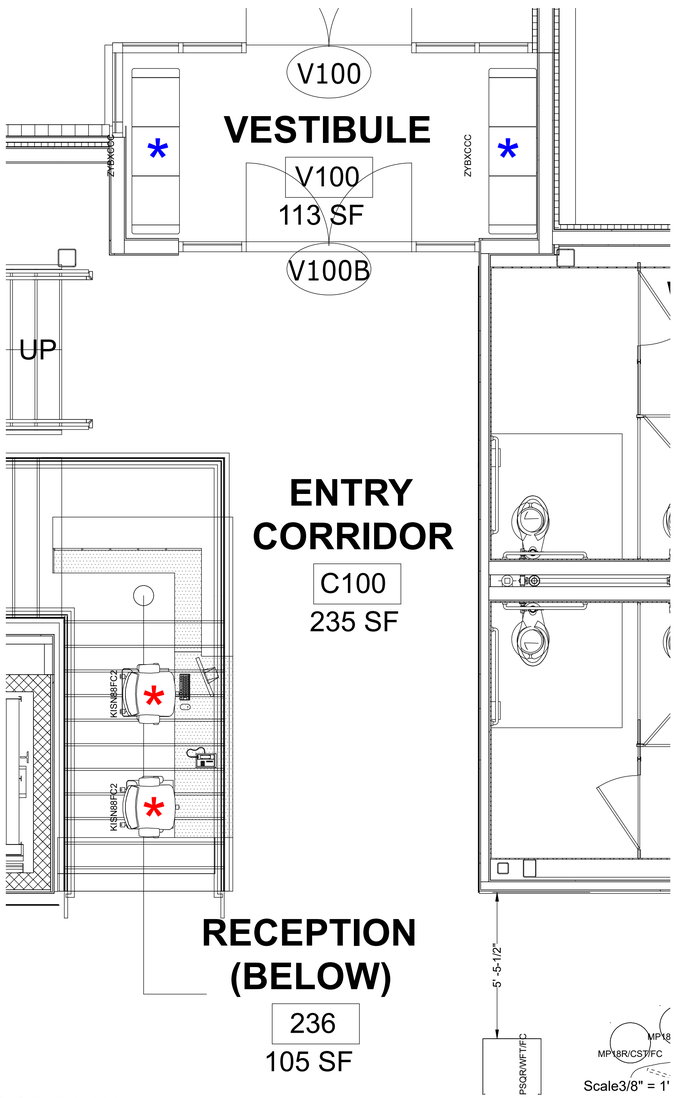
4/2/2025 3:21:51 PM Karinne Skazak

SHEET: 4/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
V100 VESTIBULE					
1 *	2	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
2 *	2	ZYBXCCC	ZYBXCCC	/NP/TBD/TBD/NFRHADELE/27.243.094.P/T02/TBD/TBD	Zoetry Bench, 3 Standard Seats
					Total V100 VESTIBULE

BILL OF MATERIALS



FLOOR PLAN

*

*

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED. ☐

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

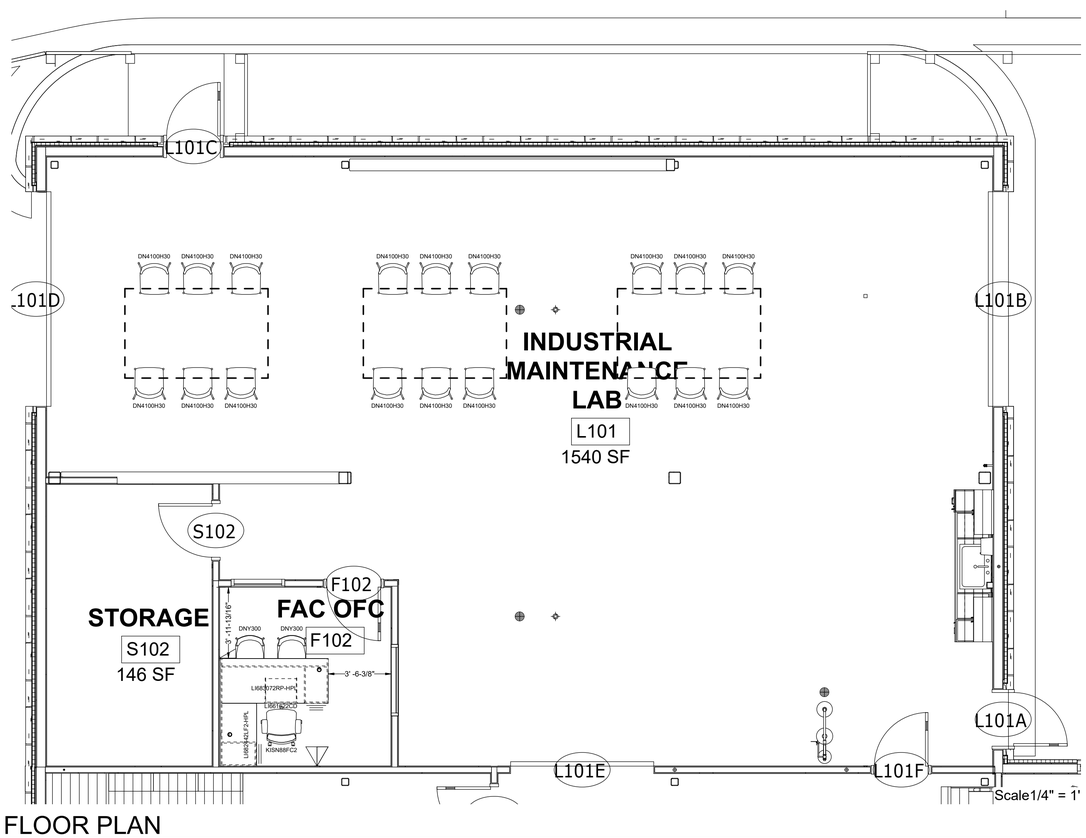
4/2/2025 3:21:53 PM Karinne Slezak

SHEET: FLOOR PLAN

5/41

#	Quantity	Ind. Tag	Part Number	Options	Description
L101 INDUSTRIAL MAINTENANCE LAB					
1	18	DN4100H30	DN4100H30	/TBD/TBD/TBD	Doni Four-Leg Armless 30" Stool,Poly,Solid Color
					Total L101 INDUSTRIAL MAINTENANCE LAB

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED. ☐

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:21:53 PM Karinne Skezak

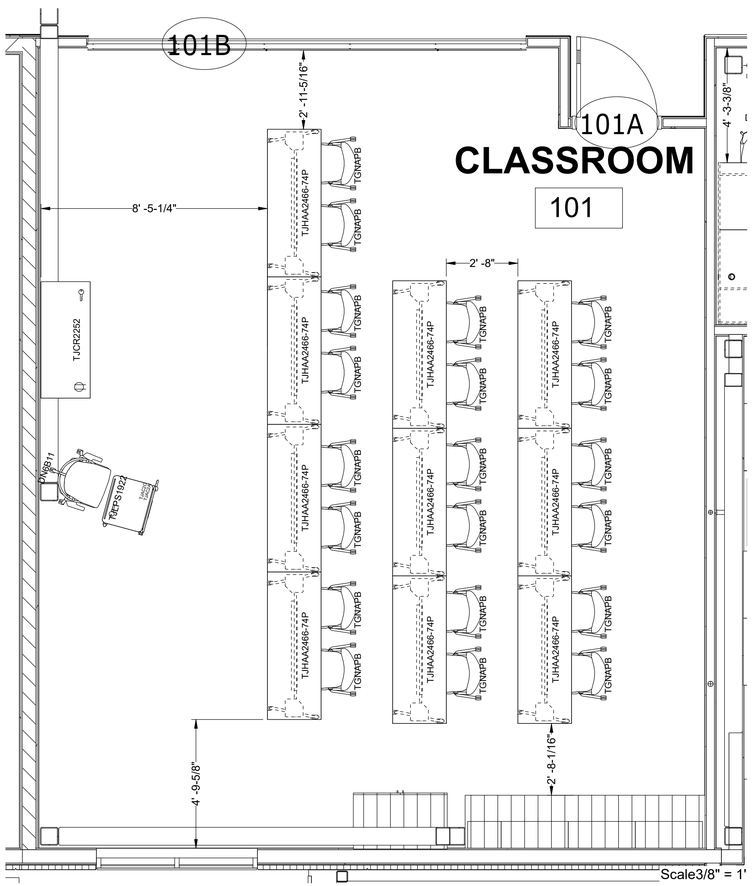
SHEET: FLOOR PLAN

6/41

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
101 CLASSROOM					
1	1	DN6B11	DN6B11	/OCG/ICO/TBD/NFRGRPP1AMPLE/27.348.042.P/TBD	Doni Task Cantilever Arm Stool,Uph Seat,Two-Tone
2	20	TGNAPB	TGNAPB	/TBD/TBD/TBD/TBD	Torsion on the Go Armless Chair,Poly Back/Upholstered Seat
3	1	TJAC2A	TJAC2A		Lectern Cup Holder Kit
4	1	TJAC2C	TJAC2C		Lectern Bag Hook Kit, With Storage
5	1	TJCR2252	TJCR2252	/TBD/TBD/TBD/WLK/SX/C/TBD/MQ1	Tributaire, Credenza, 22x52", 29"H
6	10	TJHAA2466-74P	TJHAA2466-74P	/TBD/TBD/NPA/SX/SX/C/CWG/NNN/NMP	Tributaire, Fixed Top Training,Rectangular,24x66",Fixed 29"H,74P edge
7	1	TJLPS1922	TJLPS1922	/TBD/TBD/NPA/SX/SX/TBD/WLK/C/TBD/NNN/LMP	Tributaire, Lectern,Pneumatic Height Adjustable,With Storage,19x22"
					Total 101 CLASSROOM

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

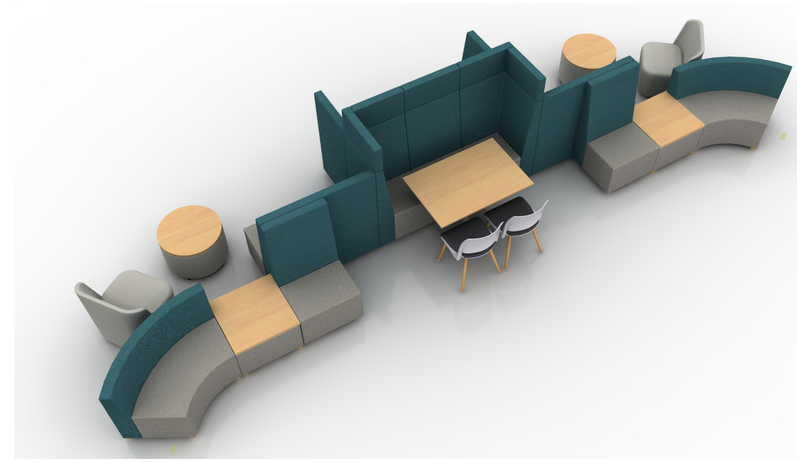
4/2/2025 3:21:54 PM Karinne Skezak

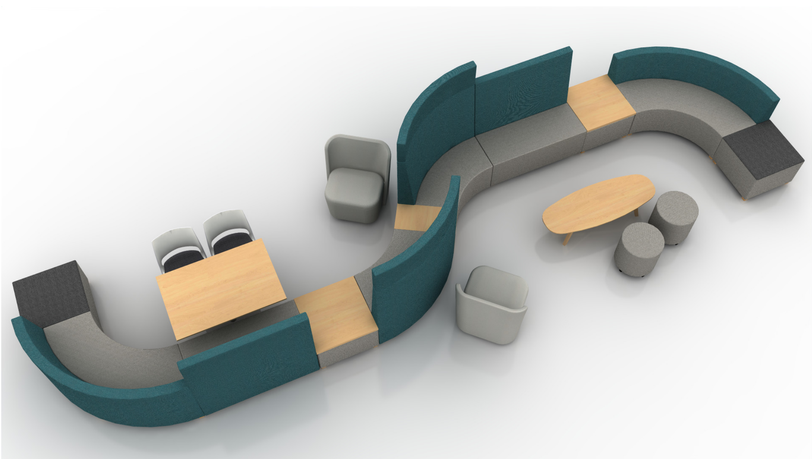
SHEET: 7/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
C101 MAIN STREET					
1	1	1418W	1418W	/TBD/TBD	Lyra Parlor Obround Coffee Table,Lam Top,Wood Leg Base
2	1	CMDAA2430-73P	CMDAA2430-73P	/TBD/TBD/TBD	C-Table Max, 29" Fixed Height, Large Rectangle Top, 24"x30" worksurface, 73P edge
3	2	CMDAB24-73P	CMDAB24-73P	/TBD/TBD/TBD	C-Table Max, 29" Fixed Height, Round Top, 24" worksurface, 73P edge
4	8	DNWB00	DNWB00	/OCG/ICO/TBD/GPL/NFRGRPP1AMPLE/27.348.042.P	Doni Tapered Wood Leg Armless Chair,Uph Seat,Two-Tone
5	2	MCIH66/WFT/FC	MCIH66/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Inside Back 60" Curve, 60" High-Back, Wood Feet, Contrast
6	1	MCNH60L/WFT/FC	MCNH60L/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Corner with 60" High-Back, Left-Facing Seat Uph. Direction, Wood Feet, Contrast
7	1	MCNH60R/WFT/FC	MCNH60R/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Corner with 60" High-Back, Right-Facing Seat Uph. Direction, Wood Feet, Contrast
8	2	MP18R/CST/FC	MP18R/CST/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.P/NMB	MyPlace 18" Round,2" Casters,Contrast
9	2	MPCI60/WFT/FC	MPCI60/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Inside Back 60" Curve, 2" Wood Feet, Contrast
10	6		MPGANGKIT		MyPlace Ganger Kit
11	2		MPHB2SDGANG		MyPlace High-Back Model Back-to-Side Gangers
12	6		MPHBLBGANG		MyPlace High-Back to Low-Back Gangers
13	2	MPICB/WFT/FC	MPICB/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/NMB/TBD	MyPlace Inside Back 90" Curve,2" Wood Feet,Contrast
14	2	MPSQR/WFT/FC	MPSQR/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.082.P/NP/TBD/NMB	MyPlace 26" Square,2" Wood Feet,Contrast
15	2	MPT26R/CST/NC	MPT26R/CST/NC	/TBD/TBD/TBD/NMB	MyPlace 26" Round Table,2" Casters,Non-Contrast
16	4	MPTSQR/WFT/NC	MPTSQR/WFT/NC	/NFRHADELE/27.243.072.P/TBD/TBD/TBD/NMB	MyPlace Square Table,2" Wood Feet,Non-Contrast
17	4	MRBH48/WFT/FC	MRBH48/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Rectangle with 48" High-Back, Wood Feet, Contrast
18	4	MSQH48/WFT/FC	MSQH48/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Lounge Chair, 48" High-Back, Wood Feet, Contrast
19	1	MSQH60/WFT/FC	MSQH60/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Lounge Chair, 60" High-Back, Wood Feet, Contrast
20	1	MYPTED/WFT	MYPTED/WFT	/TBD/TBD/TBD/TBD/TBD	MyPlace Rectangular In-Line Table Without Pad, 2" Wood Feet
21	4	SN11NC	SN11NC	/CST/TBD/TBD	Sonrisa Lounge Chair, Armless, Non-contrast
22	2	TADAA3044	TADAA3044	/73P/TBD/TBD/TBD	Tattoo Table,Rectangle, 3" Column,23" Base,29"H, 30x44"
23	2	TJCAB36-74P	TJCAB36-74P	/TBD/TBD/NPA/SX/GLP/NNN	Tributaire, Cafe X-Base, Round,36", 29"H,74P edge
24	4	ZK060FC	ZK060FC	/NPHHALEA/27.293.169.PHALEA/27.293.072.P	Zeker Inside Curve, Low Back, Contrast
25	2	ZK080FC	ZK080FC	/NPHHALEA/27.293.169.PHALEA/27.293.072.P	Zeker Extended Outside Curve, Low Back, Contrast
26	2	ZK901GNG	ZK901GNG		Zeker Ganging Kit
					Total C101 MAIN STREET

BILL OF MATERIALS

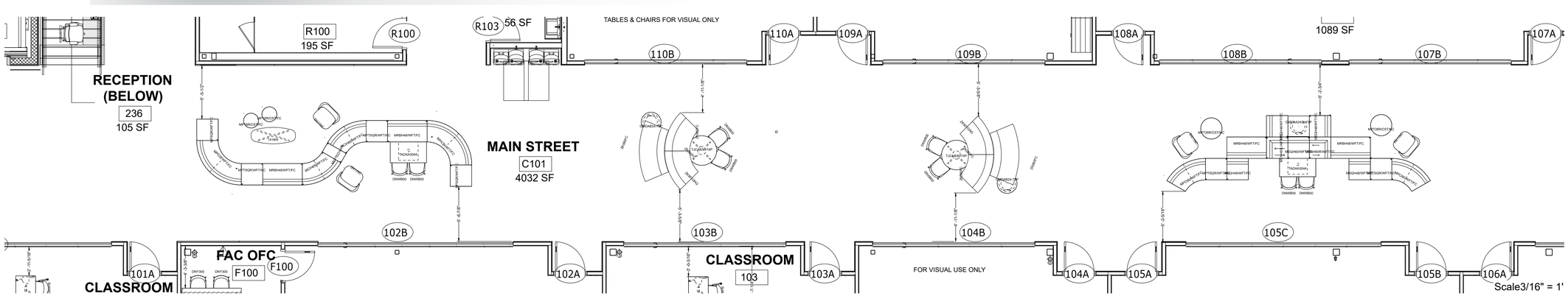




RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown



FLOOR PLAN

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI REGOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:21:55 PM Karinne Slezak

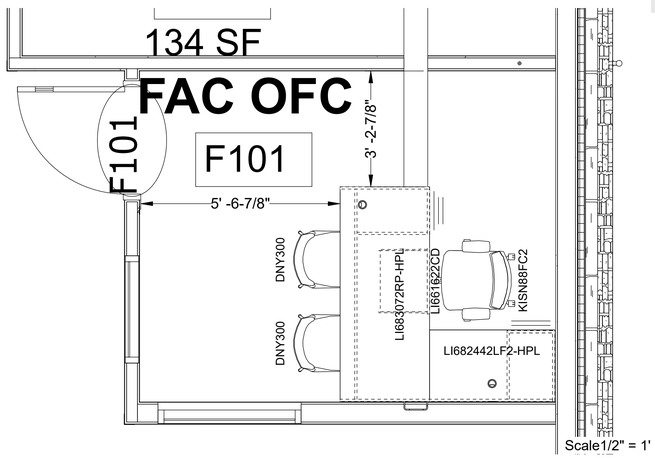
SHEET: FLOOR PLAN

8/41

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
F101 FACULTY OFFICE					
1	2	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
4	1	LI682442LF2-HPL	LI682442LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,42"Wx24"Dx30"H,HPL
5	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
					Total F101 FACULTY OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

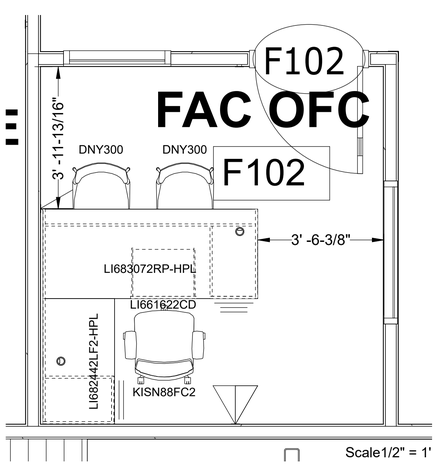
4/2/2025 3:21:57 PM Karinne Skazak

SHEET: 9/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
F102 FACULTY OFFICE					
1	2	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
4	1	LI682442LF2-HPL	LI682442LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,42"Wx24"Dx30"H,HPL
5	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
					Total F102 FACULTY OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

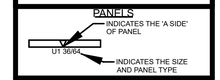
APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

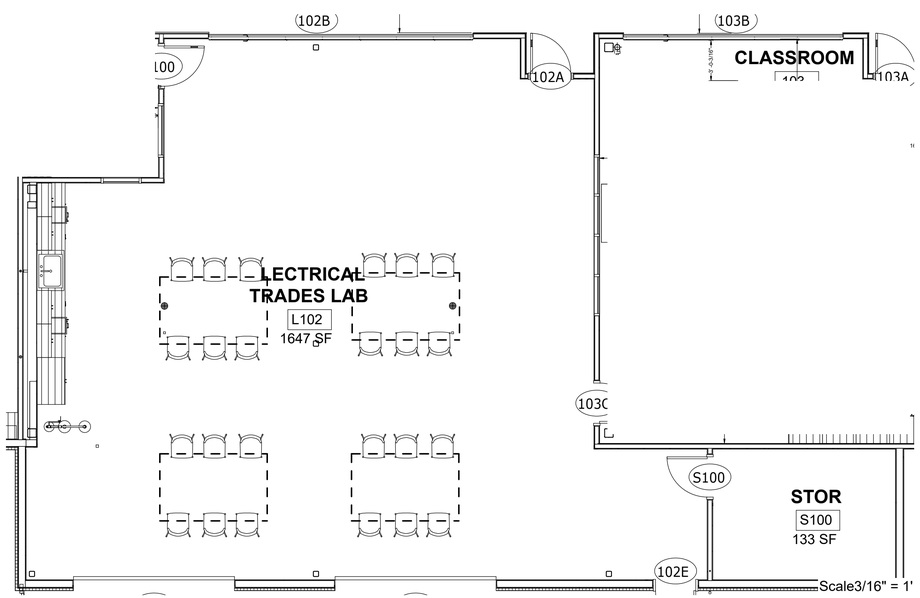
4/2/2025 3:21:58 PM Karinne Slezak

SHEET: 10/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
L102 ELECTRICAL TRADES LAB					
1	24	DN4100H30	DN4100H30	/TBD/TBD/TBD	Doni Four-Leg Armless 30" Stool,Poly,Solid Color
					Total L102 ELECTRICAL TRADES LAB

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

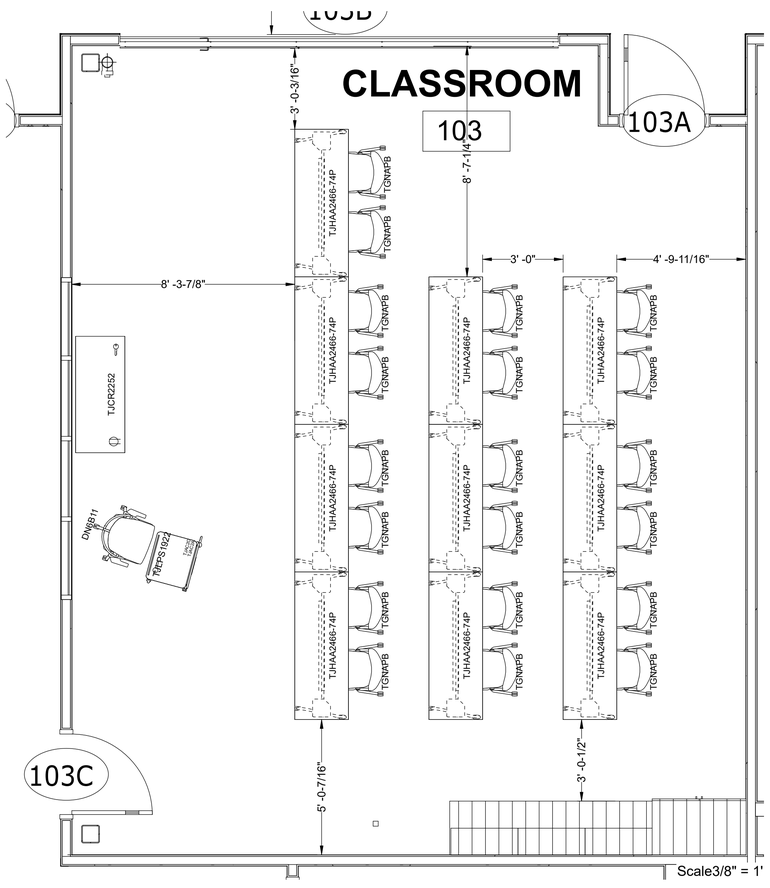
4/2/2025 3:21:55 PM Karinne Skezak

SHEET: 11/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
103 CLASSROOM					
1	1	DN6B11	DN6B11	/OCG/ICO/TBD/NFRGRPP1AMPLE/27.348.042.P/TBD	Doni Task Cantilever Arm Stool,Uph Seat,Two-Tone
2	20	TGNAPB	TGNAPB	/TBD/TBD/TBD/TBD	Torsion on the Go Armless Chair,Poly Back/Upholstered Seat
3	1	TJAC2A	TJAC2A		Lectern Cup Holder Kit
4	1	TJAC2C	TJAC2C		Lectern Bag Hook Kit, With Storage
5	1	TJCR2252	TJCR2252	/TBD/TBD/TBD/WLK/SX/C/TBD/MQ1	Tributaire, Credenza, 22x52", 29"H
6	10	TJHAA2466-74P	TJHAA2466-74P	/TBD/TBD/NPA/SX/SX/C/CWG/NNN/NMP	Tributaire, Fixed Top Training,Rectangular,24x66",Fixed 29"H,74P edge
7	1	TJLPS1922	TJLPS1922	/TBD/TBD/NPA/SX/SX/TBD/WLK/C/TBD/NNN/LMP	Tributaire, Lectern,Pneumatic Height Adjustable,With Storage,19x22"
					Total 103 CLASSROOM

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

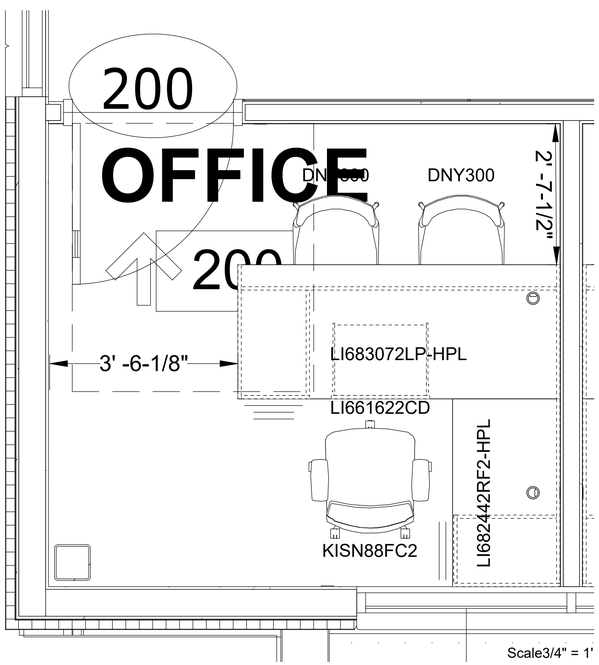
4/2/2025 3:22:00 PM Karinne Slezak

SHEET: 12/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
200 OFFICE					
1	2	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
4	1	LI682442RF2-HPL	LI682442RF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Right File/File,42"Wx24"Dx30"H,HPL
5	1	LI683072LP-HPL	LI683072LP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Left,72"Wx30"Dx30"H,HPL
					Total 200 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

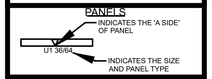
APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:22:01 PM Karinne Slezak

SHEET: 13/41 FLOOR PLAN

V24.1

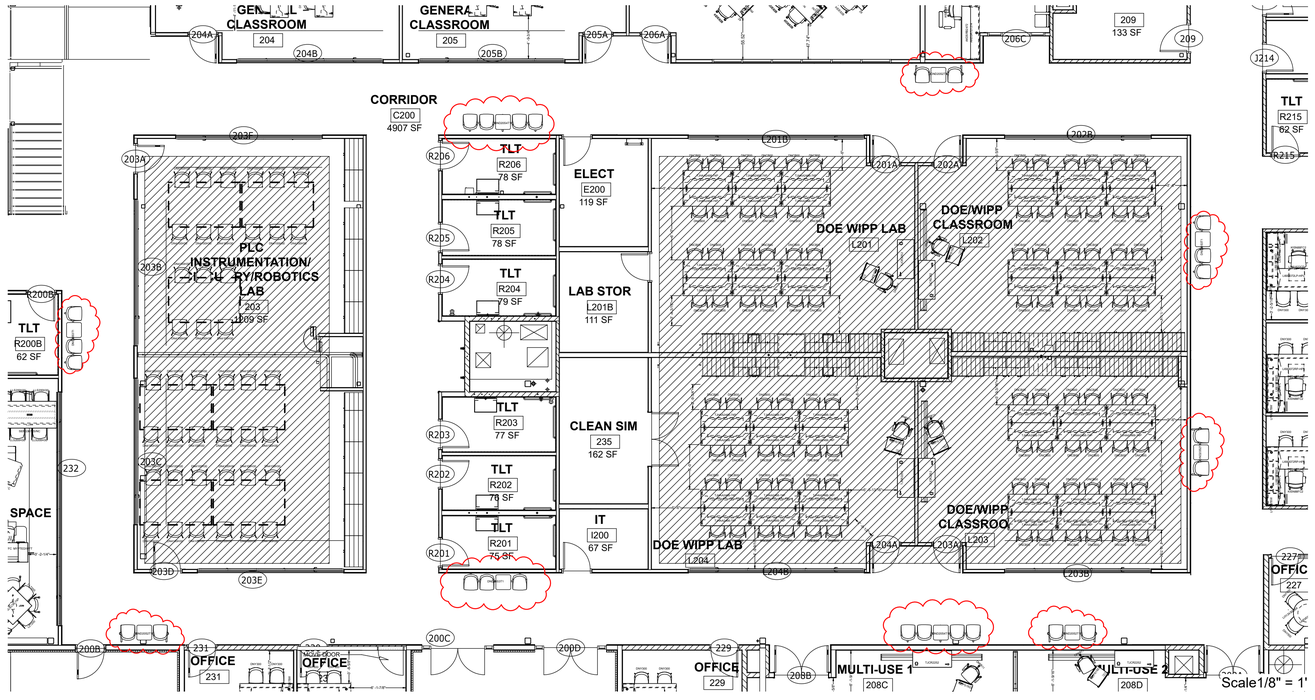
#	Quantity	Ind. Tag	Part Number	Options	Description
C200 CORRIDOR					
1	4	DND20S2T1	DND20S2T1	/TBD-NFR/PCO/TBD/NFRGRPP1AMPLE/27.348.042.P	Doni Tandem,2-Seat,1 In-Line Tbl,No Arms,Uph Seat,Solid Color
2	3	DND20S3T1	DND20S3T1	/TBD-NFR/PCO/TBD/NFRGRPP1AMPLE/27.348.042.P	Doni Tandem,3-Seat,1 In-Line Tbl,No Arms,Uph Seat,Solid Color
3	2	DND20S4T1	DND20S4T1	/TBD-NFR/PCO/TBD/NFRGRPP1AMPLE/27.348.042.P	Doni Tandem,4-Seat,1 In-Line Tbl,No Arms,Uph Seat,Solid Color
					Total C200 CORRIDOR

BILL OF MATERIALS

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown



FLOOR PLAN

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College:
Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #:
718801

DATE:
11/25/24

REVISIONS:

NO	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY:
KARINNE

SCALE:
AS NOTED

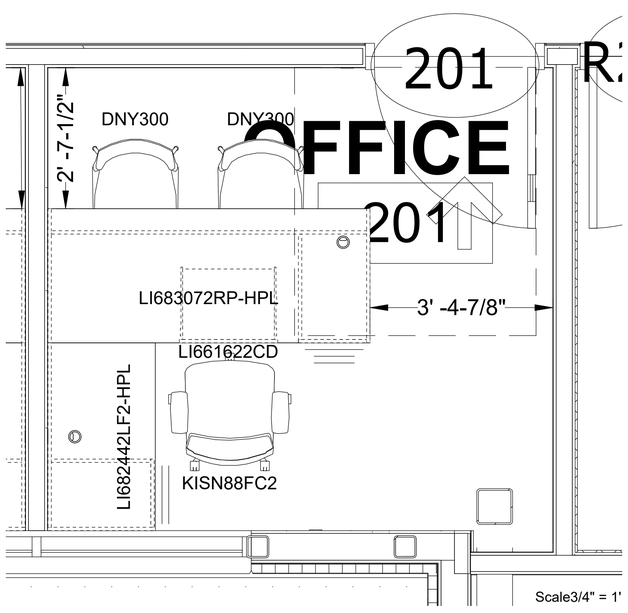
DRAWING #:
718801_00_00_L07.cmdrw
4/2/2025 3:22:02 PM Karinne Slezak

SHEET: FLOOR PLAN
14/41

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
201 OFFICE					
1	2	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
4	1	LI682442LF2-HPL	LI682442LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,42"Wx24"Dx30"H,HPL
5	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
					Total 201 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

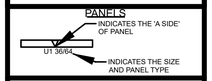
APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

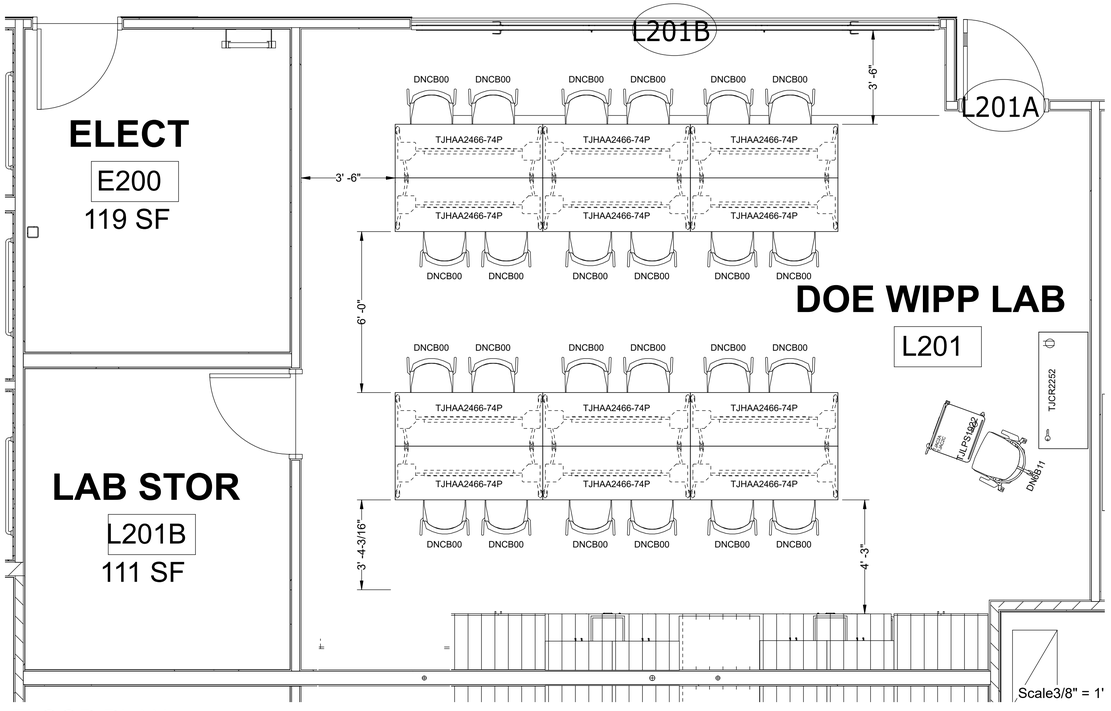
4/2/2025 3:22:04 PM Karinne Slezak

SHEET: 15/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
L201 DOE/WIIP LAB					
1	1	DN6B11	DN6B11	/OCG/ICO/TBD/NFRGRPP1AMPLE/27.348.042.P/TBD	Doni Task Cantilever Arm Stool,Uph Seat,Two-Tone
2	24	DNCB00	DNCB00	/OCG/ICO/TBD/TBD/NFRGRPP1AMPLE/27.348.042.P	Doni Four-Leg Armless Wallsaver Chair,Uph Seat,Two-Tone
3	1	TJAC2A	TJAC2A		Lectern Cup Holder Kit
4	1	TJAC2C	TJAC2C		Lectern Bag Hook Kit, With Storage
5	1	TJCR2252	TJCR2252	/TBD/TBD/TBD/WLK/SX/C/TBD/MQ1	Tributaire, Credenza, 22x52", 29"H
6	12	TJHAA2466-74P	TJHAA2466-74P	/TBD/TBD/NPA/SX/SX/C/CWG/NNN/NMP	Tributaire, Fixed Top Training,Rectangular,24x66",Fixed 29"H,74P edge
7	1	TJLPS1922	TJLPS1922	/TBD/TBD/NPA/SX/SX/TBD/WLK/C/TBD/NNN/LMP	Tributaire, Lectern,Pneumatic Height Adjustable,With Storage,19x22"
					Total L201 DOE/WIIP LAB

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

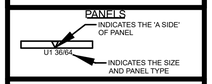
APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

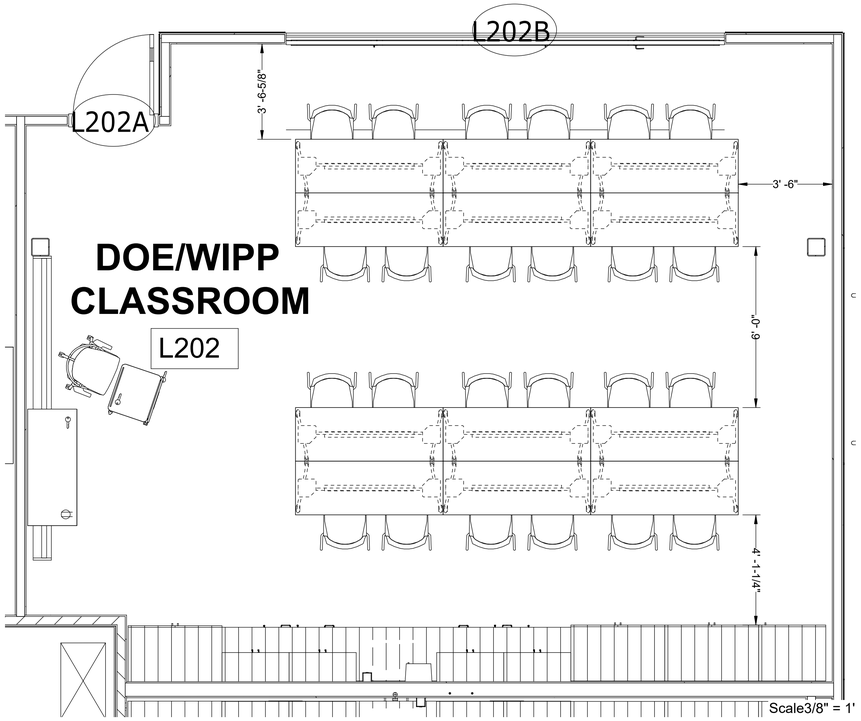
4/2/2025 3:22:04 PM Karinne Slezak

SHEET: FLOOR PLAN

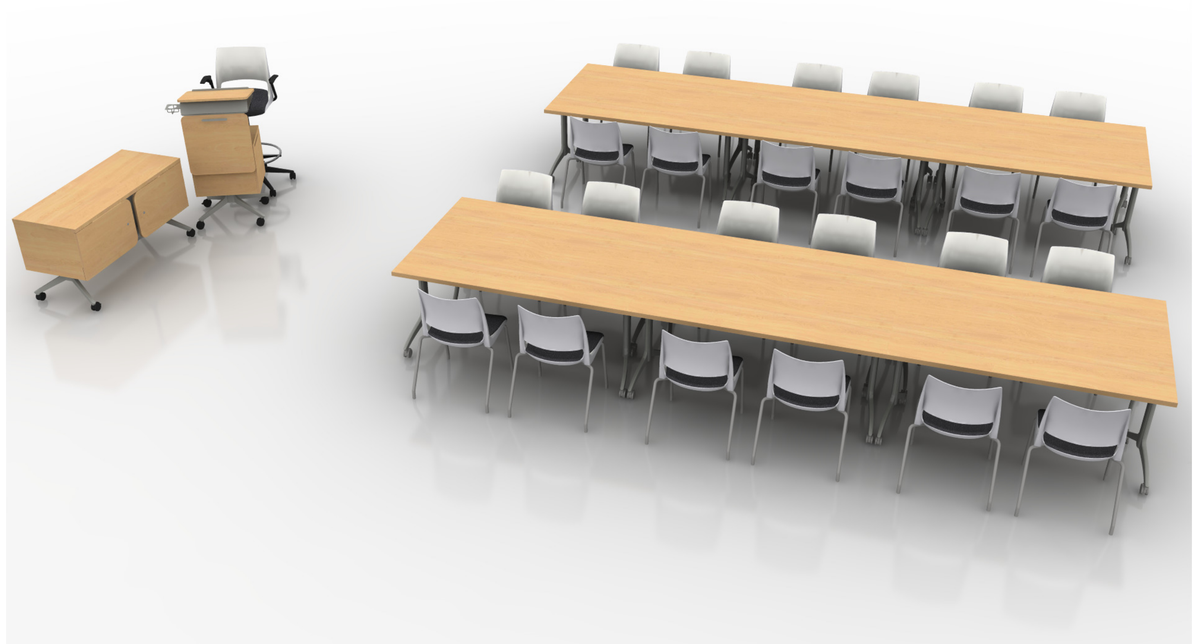
16/41

#	Quantity	Ind. Tag	Part Number	Options	Description
L202 DOE/WIIP CLASSROOM					
1	1	DN6B11	DN6B11	/OCG/ICO/TBD/NFRGRPP1AMPLE/27.348.042.P/TBD	Doni Task Cantilever Arm Stool,Uph Seat,Two-Tone
2	24	DNCB00	DNCB00	/OCG/ICO/TBD/TBD/NFRGRPP1AMPLE/27.348.042.P	Doni Four-Leg Armless Wallsaver Chair,Uph Seat,Two-Tone
3	1	TJAC2A	TJAC2A		Lectern Cup Holder Kit
4	1	TJAC2C	TJAC2C		Lectern Bag Hook Kit, With Storage
5	1	TJCR2252	TJCR2252	/TBD/TBD/TBD/WLK/SX/C/TBD/MQ1	Tributaire, Credenza, 22x52", 29"H
6	12	TJHAA2466-74P	TJHAA2466-74P	/TBD/TBD/NPA/SX/SX/C/CWG/NNN/NMP	Tributaire, Fixed Top Training,Rectangular,24x66",Fixed 29"H,74P edge
7	1	TJLPS1922	TJLPS1922	/TBD/TBD/NPA/SX/SX/TBD/WLK/C/TBD/NNN/LMP	Tributaire, Lectern,Pneumatic Height Adjustable,With Storage,19x22"
					Total L202 DOE/WIIP CLASSROOM

BILL OF MATERIALS



FLOOR PLAN



RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

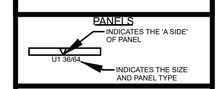
THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:22:05 PM Karinne Slezak

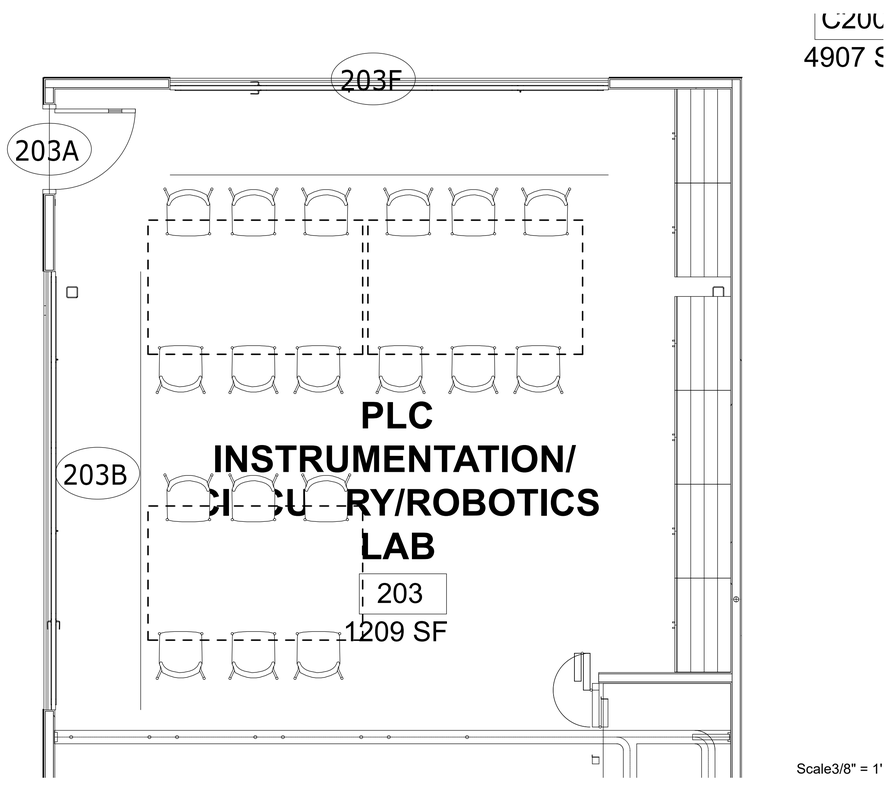
SHEET: FLOOR PLAN

17/41

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
203A PLC INSTRUMENTATION/ ROBOTICS LAB					
1	18	DN4100H30	DN4100H30	/TBD/TBD/TBD	Doni Four-Leg Armless 30" Stool,Poly,Solid Color
					Total 203A PLC INSTRUMENTATION/ROBOTICS LAB

BILL OF MATERIALS



Scale3/8" = 1'

FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO	DATE	BY	DESCRIPTION
1	02/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

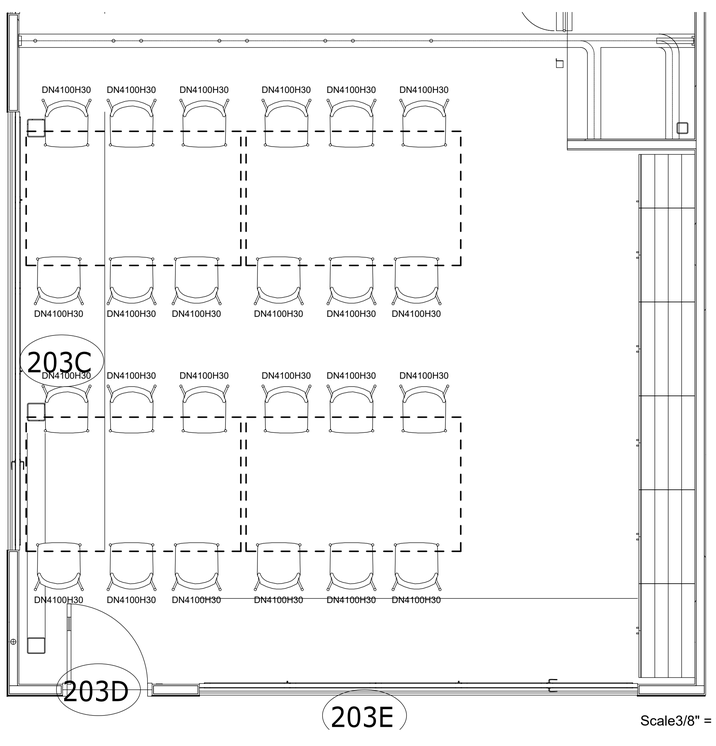
DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:22:06 PM Karinne Slezak

SHEET: 18/41 FLOOR PLAN

#	Quantity	Ind. Tag	Part Number	Options	Description
203D CLASSROOM					
1	24	DN4100H30	DN4100H30	/TBD/TBD/TBD	Doni Four-Leg Armless 30" Stool,Poly,Solid Color
					Total 203D CLASSROOM

BILL OF MATERIALS



Scale3/8" = 1'

FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

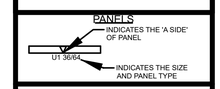
APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

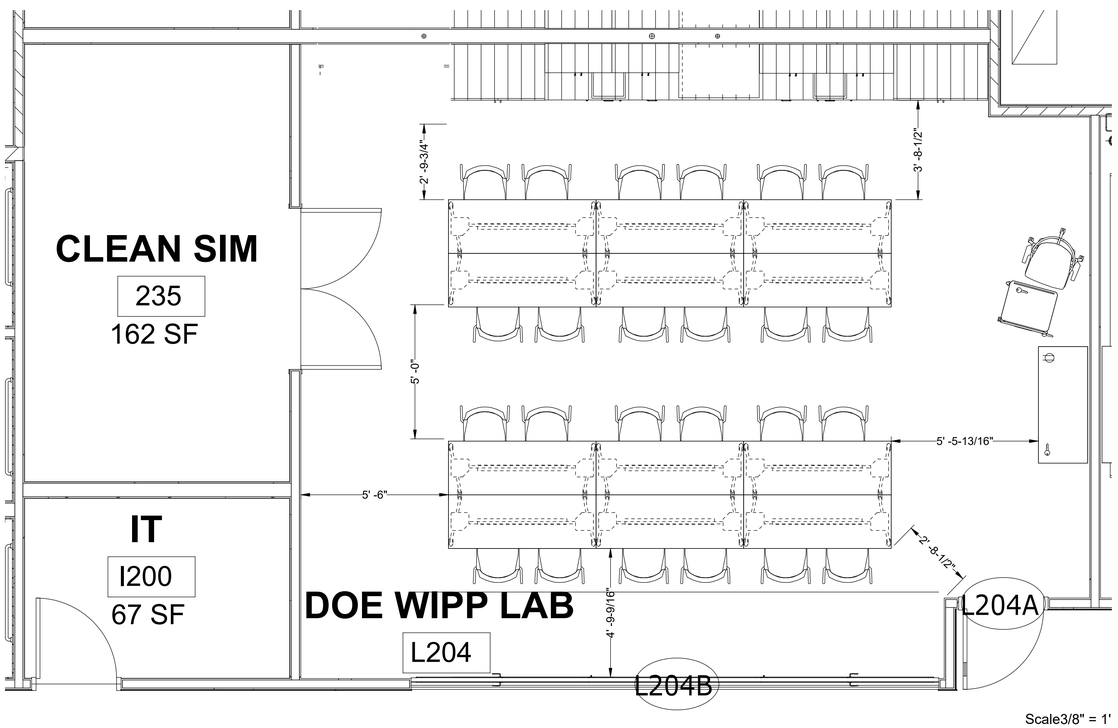
4/2/2025 3:22:07 PM Karinne Slezak

SHEET: 19/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
L204 DOE/WIIP LAB					
1	1	DN6B11	DN6B11	/OCG/ICO/TBD/NFRGRPP1AMPLE/27.348.042.P/TBD	Doni Task Cantilever Arm Stool,Uph Seat,Two-Tone
2	24	DNCB00	DNCB00	/OCG/ICO/TBD/TBD/NFRGRPP1AMPLE/27.348.042.P	Doni Four-Leg Armless Wallsaver Chair,Uph Seat,Two-Tone
3	1	TJAC2A	TJAC2A		Lectern Cup Holder Kit
4	1	TJAC2C	TJAC2C		Lectern Bag Hook Kit, With Storage
5	1	TJCR2252	TJCR2252	/TBD/TBD/TBD/WLK/SX/C/TBD/MQ1	Tributaire, Credenza, 22x52", 29"H
6	12	TJHAA2466-74P	TJHAA2466-74P	/TBD/TBD/NPA/SX/SX/C/CWG/NNN/NMP	Tributaire, Fixed Top Training,Rectangular,24x66",Fixed 29"H,74P edge
7	1	TJLPS1922	TJLPS1922	/TBD/TBD/NPA/SX/SX/TBD/WLK/C/TBD/NNN/LMP	Tributaire, Lectern,Pneumatic Height Adjustable,With Storage,19x22"
					Total L204 DOE/WIIP LAB

BILL OF MATERIALS



Scale3/8" = 1'

FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

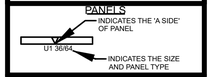
APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

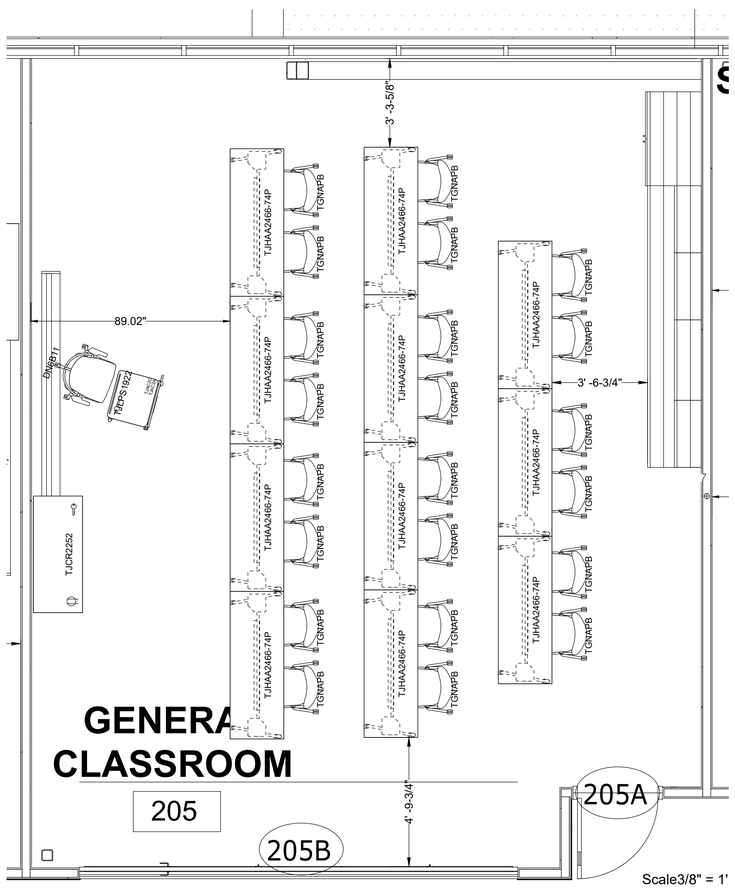
4/2/2025 3:22:08 PM Karinne Slezak

SHEET: FLOOR PLAN 20/41

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
205 GENERAL CLASSROOM					
1	1	DN6B11	DN6B11	/OCG/ICO/TBD/NFRGRPP1AMPLE/27.348.042.P/TBD	Doni Task Cantilever Arm Stool,Uph Seat,Two-Tone
2	22	TGNAPB	TGNAPB	/TBD/TBD/TBD/TBD	Torsion on the Go Armless Chair,Poly Back/Upholstered Seat
3	1	TJAC2A	TJAC2A		Lectern Cup Holder Kit
4	1	TJAC2C	TJAC2C		Lectern Bag Hook Kit, With Storage
5	1	TJCR2252	TJCR2252	/TBD/TBD/TBD/WLK/SX/C/TBD/MQ1	Tributaire, Credenza, 22x52", 29"H
6	11	TJHAA2466-74P	TJHAA2466-74P	/TBD/TBD/NPA/SX/SX/C/CWG/NNN/NMP	Tributaire, Fixed Top Training,Rectangular,24x66",Fixed 29"H,74P edge
7	1	TJLPS1922	TJLPS1922	/TBD/TBD/NPA/SX/SX/TBD/WLK/C/TBD/NNN/LMP	Tributaire, Lectern,Pneumatic Height Adjustable,With Storage,19x22"
					Total 205 GENERAL CLASSROOM

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT AS SUCH. THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

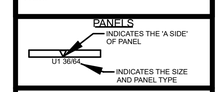
APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

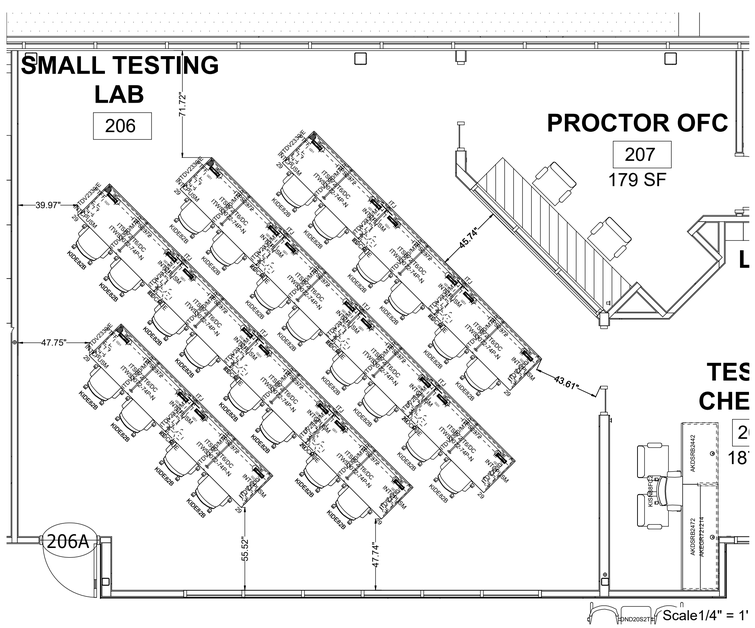
4/2/2025 3:22:08 PM Karinne Slezak

SHEET: FLOOR PLAN

21/41

#	Quantity	Ind. Tag	Part Number	Options	Description
206 SMALL TESTING LAB					
1	8		47.0706.1.BL		15-Amp Duplex Receptacle,10-Wire/6-2-2,Circuit 1, Black
2	9		47.0706.2.BL		15-Amp Duplex Receptacle,10-Wire/6-2-2,Circuit 2, Black
3	9		47.0706.3.BL		15-Amp Duplex Receptacle,10-Wire/6-2-2,Circuit 3, Black
4	9	ITJ	48.0268.23		10 Wire Inline Table-To-Table Jumper, 6 Circuit,23"L
5	26	GD1	GRM.GD1		Kit, Metal Grommet for Dean
6	17	INTCPUSM	INTCPUSM		CPU Clamp - Small
7	17	29	ITCL3029	/SX	InTandem "C" Leg,30"D,29"H
8	8	ITDV2330/E	ITDV2330/E	/TBD	SmartLift/InTandem End Divider Screen,23"Hx30"W
9	22	ITDV2330/M74P	ITDV2330/M74P	/TBD	SmartLift/InTandem Middle Divider Screen,74P Edge,23"Hx30"W
10	13	ITPS2372	ITPS2372	/TBD	InTandem Privacy Screen,Rect,23"Hx72"W
11	13	ITSB72/T6/DC	ITSB72/T6/DC	/SX	InTandem Rectangular Beam,72"W,10-Wire w/Data Cover
12	4	ITWS3072-74P-N	ITWS3072-74P-N	/TBD/ECG/CSD	InTandem Worksurface,Rectangle,2-Cutouts,No Feed,30x72",74P Edge
13	9	ITWS3072-74P-N	ITWS3072-74P-N	/TBD/ECG/CSD	InTandem Worksurface,Rectangle,2-Cutouts,No Feed,30x72",74P Edge
14	38	KIDE82B	KIDE82B	/TBD/TBD/TBD	Diem Weight-Activated Task Chair, 1D Arms
15	9	KOCPUE	KOCPUE		Compact CPU Holder (Max. CPU size 9.8"W x 20"H)
16	4	PTFF	PTFF	/WG	Base Infeed 10 Wire/6 Circuit
					Total 206 SMALL TESTING LAB

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

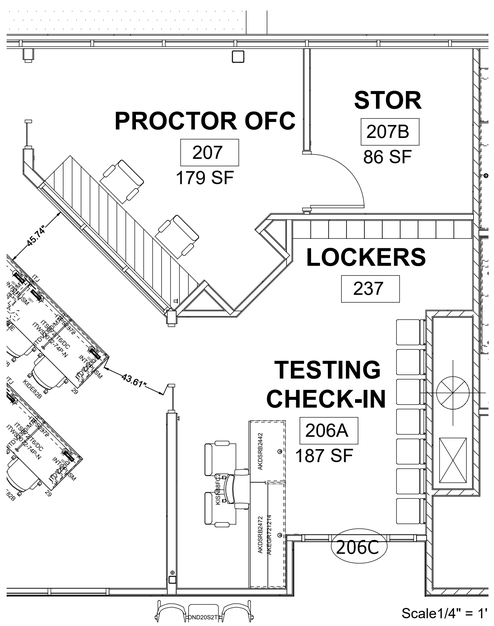
4/2/2025 3:22:05 PM Karinne Skazak

SHEET: 22/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
206A TEST CHECK-IN					
1	1	AKDSRB2442	AKDSRB2442	/LFH/LBFH	Orenda Desk Shell Rectangle 24x42, 29"H Flush Back Panel, 1 Full End Panel, Full Modesty Panel, 1" TFL Smooth Edge
2	1	AKDSRB2472	AKDSRB2472	/LFH/LBFH	Orenda Desk Shell Rectangle 24x72, 29"H Flush Back Panel, 1 Full End Panel, Full Modesty Panel, 1" TFL Smooth Edge
3	1	AKEGR721214	AKEGR721214	/LFH/LBFH	Orenda Reception Gallery Rectangle 72"Wx12"Dx14"H,1" TFL Smooth Edge
4	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
					Total 206A TEST CHECK-IN

BILL OF MATERIALS



Scale1/4" = 1'

FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

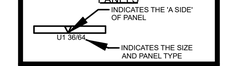
APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

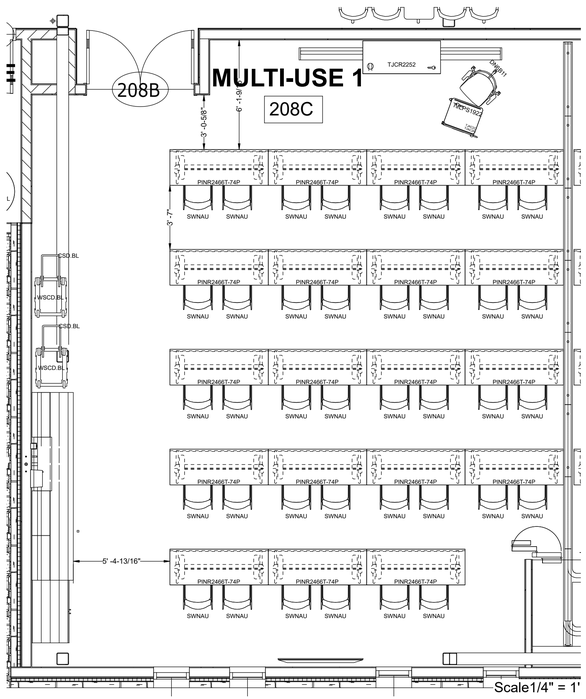
4/2/2025 3:22:10 PM Karinne Skazak

SHEET: 23/41 FLOOR PLAN

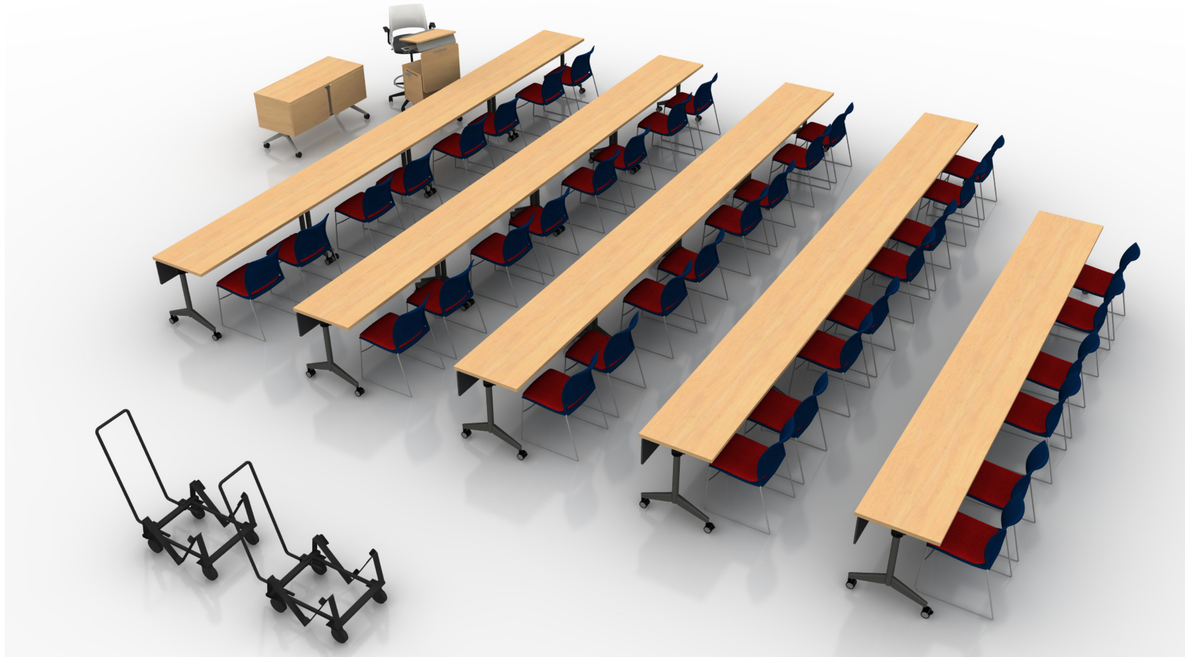
V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
208C MULTI-USE 1					
1	1	DN6B11	DN6B11	/OCG/ICO/TBD/NFRGRPP1AMPLE/27.348.042.P/TBD	Doni Task Cantilever Arm Stool,Uph Seat,Two-Tone
2	19	PINR2466T-74P	PINR2466T-74P	/EKM/NNN/FN/4EC/PMP/FTFNLAMG1LAMGRD1STD/LKM	Pirouette,Nesting Training,Rectangular,24x66",74P Edge
3	38	SWNAU	SWNAU	/TBD/NFRGRPP1ADELE/27.243.168.P/TBD/TBD	Strive High Density Armless Chair,Uph Seat
4	1	TJAC2A	TJAC2A		Lectern Cup Holder Kit
5	1	TJAC2C	TJAC2C		Lectern Bag Hook Kit, With Storage
6	1	TJCR2252	TJCR2252	/TBD/TBD/TBD/WLK/SX/C/TBD/MQ1	Tributaire, Credenza, 22x52", 29"H
7	1	TJLPS1922	TJLPS1922	/TBD/TBD/NPA/SX/SX/TBD/WLK/C/TBD/NNN/LMP	Tributaire, Lectern,Pneumatic Height Adjustable,With Storage,19x22"
8	2	CSD.BL	UDH.BL		Universal Dolly Handle
9	2	WSCD.BL	WSCD.BL		Transport Dolly for Strive HD Chairs
					Total 208C MULTI-USE 1

BILL OF MATERIALS



FLOOR PLAN



RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 35/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

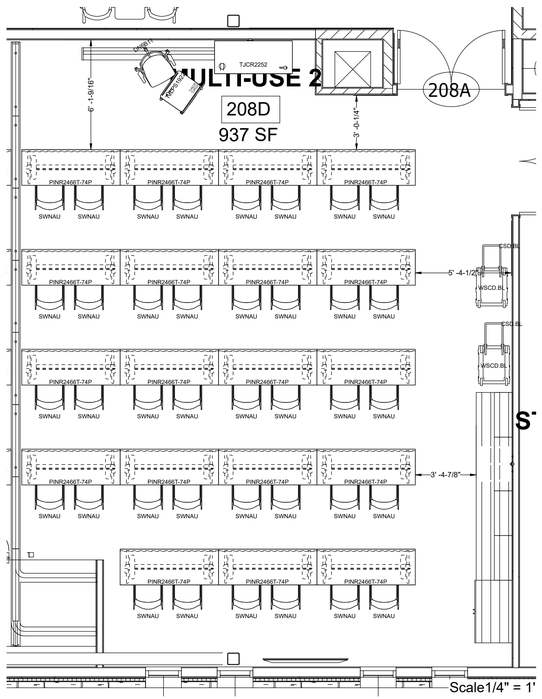
4/2/2025 3:22:11 PM Karinne Skezak

SHEET: 24/41 FLOOR PLAN

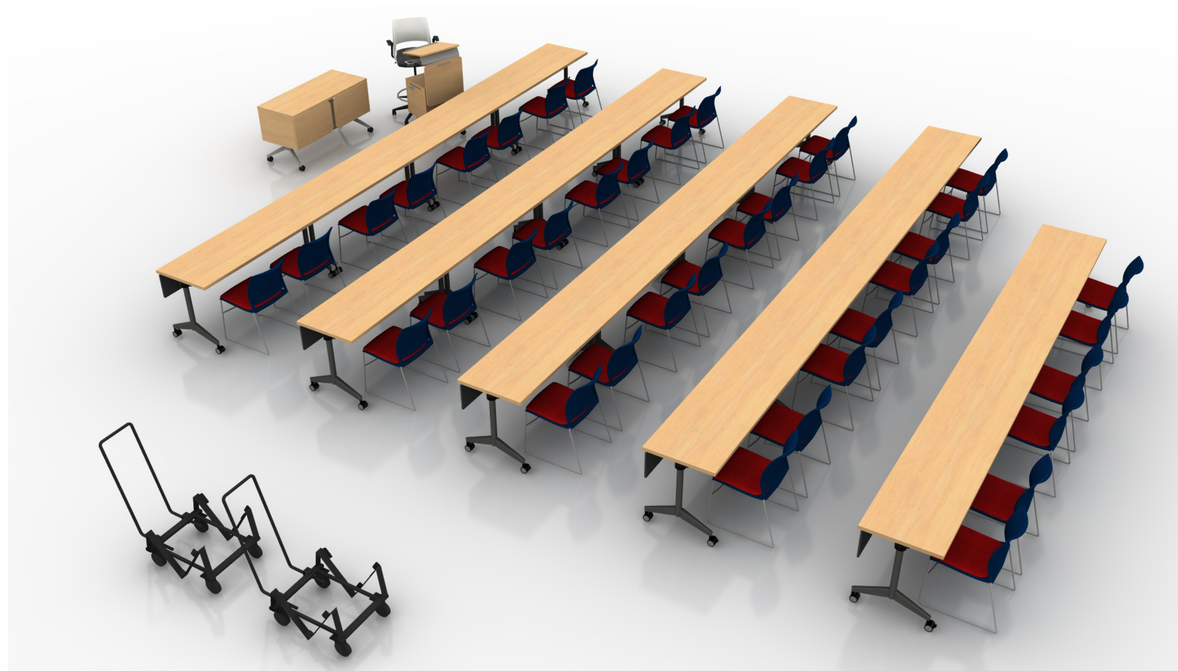
V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
208D MULTI-USE 2					
1	1	DN6B11	DN6B11	/OCG/ICO/TBD/NFRGRPP1AMPLE/27.348.042.P/TBD	Doni Task Cantilever Arm Stool,Uph Seat,Two-Tone
2	19	PINR2466T-74P	PINR2466T-74P	/EKM/NNN/FN/4EC/PMP/FTFNLAMG1LAMGRD1STD/LKM	Pirouette,Nesting Training,Rectangular,24x66",74P Edge
3	38	SWNAU	SWNAU	/TBD/NFRGRPP1ADELE/27.243.168.P/TBD/TBD	Strive High Density Armless Chair,Uph Seat
4	1	TJAC2A	TJAC2A		Lectern Cup Holder Kit
5	1	TJAC2C	TJAC2C		Lectern Bag Hook Kit, With Storage
6	1	TJCR2252	TJCR2252	/TBD/TBD/TBD/WLK/SX/C/TBD/MQ1	Tributaire, Credenza, 22x52", 29"H
7	1	TJLPS1922	TJLPS1922	/TBD/TBD/NPA/SX/SX/TBD/WLK/C/TBD/NNN/LMP	Tributaire, Lectern,Pneumatic Height Adjustable,With Storage,19x22"
8	2	CSD.BL	UDH.BL		Universal Dolly Handle
9	2	WSCD.BL	WSCD.BL		Transport Dolly for Strive HD Chairs
					Total 208D MULTI-USE 2

BILL OF MATERIALS



FLOOR PLAN



RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

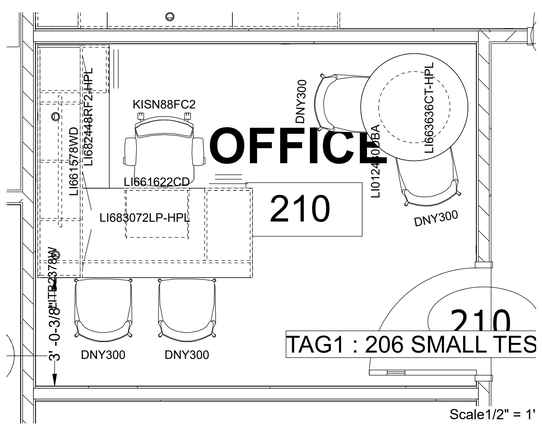
4/2/2025 3:22:15 PM Karinne Skazak

SHEET: 25/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
210 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448RF2-HPL	LI682448RF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Right File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072LP-HPL	LI683072LP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Left,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 210 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

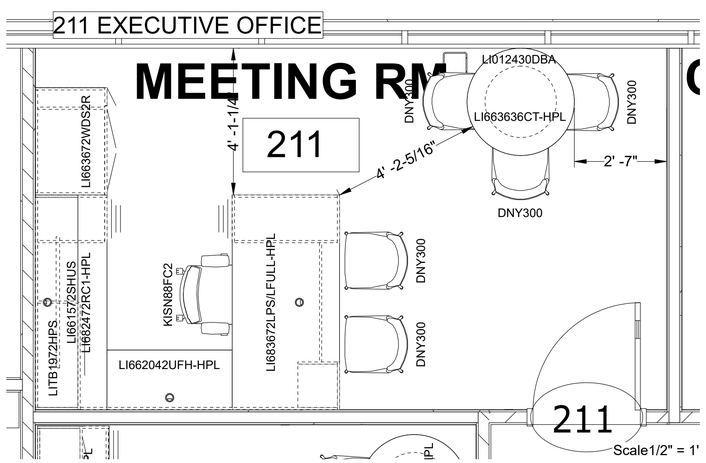
4/2/2025 3:22:13 PM Karinne Skazak

SHEET: 26/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
211 EXECUTIVE OFFICE					
1	5	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661572SHUS	LI661572SHUS	/LSL/WMHUB/GAS/PLM	Likha Hutch,Surface Mount Sliding Door, w/Paper Sorter,One Laminate Door,72"Wx15"Dx40-7/8"H
6	1	LI662042UFH-HPL	LI662042UFH-HPL	/LPW/BLSL/Y/GC/NBGRM/GAS	Likha Bridge w/Half Modesty,42"Wx20"Dx30"H,HPL
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI663672WDS2R	LI663672WDS2R	/LSL/AQD/KS/AS/NDL	Likha 72"H Wardrobe/Storage Cabinet,Half Open w/Laminate Hutch Doors,Hinge Right,36x24x70-7/8"
9	1	LI682472RC1-HPL	LI682472RC1-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Credenza,Full Pedestal-Box/Box/File-Right,72"Wx24"Dx30"H,HPL
10	1	LI683672LPS/LFULL-HPL	LI683672LPS/LFULL-HPL	/LPW/BLSL/AQD/Y/GC/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Stepped Front,Full Laminate Modesty Panel-Left,72"Wx36"Dx30"H,HPL
11	1	LITB1972HPS	LITB1972HPS	/GRPV/RATTAN/28.069.064.P	Likha 19"H Tackboard,Attach to Surface Mount Hutch w/Paper Slots,Fits 72"W
					Total 211 EXECUTIVE OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

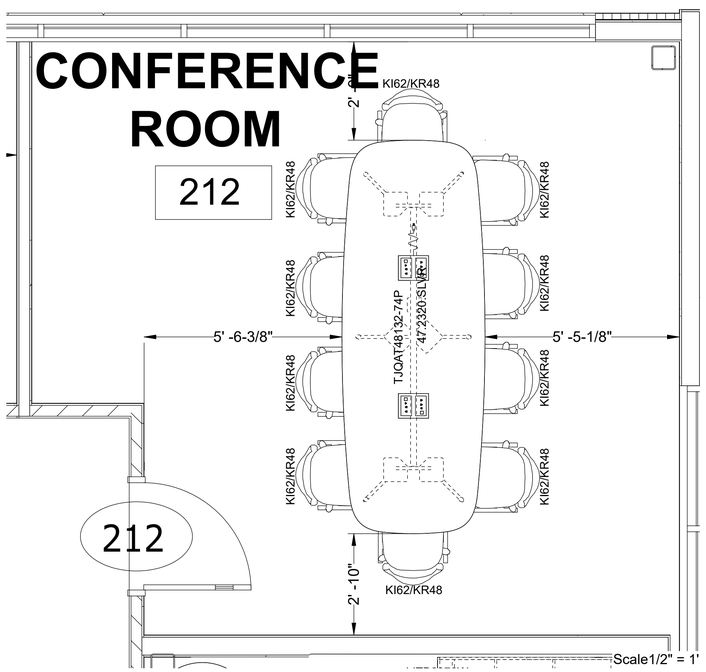
4/2/2025 3:22:14 PM Karinne Skazak

SHEET: 27/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
212 CONFERENCE					
1	1	47.2320.SLVR	47.2320.SLVR		Vertical Cable Manager
2	10	KI62/KR48	KI62/KR48	/NF/DUB2/NFRGRPP1ADELE/27.243.104.P/S-NS/SLD	Impress Task,Pedestal Base,Fixed Loop Arms,Upholstered
3	1	TJQAT48132-74P	TJQAT48132-74P	/EITLAMG1LAMGRD1STD/LIT/NPA/BL/GLP/PMA2/MWG	Tributaire, Conference,Single Circuit,Boat,48x132", 29"H,74P edge
					Total 212 CONFERENCE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

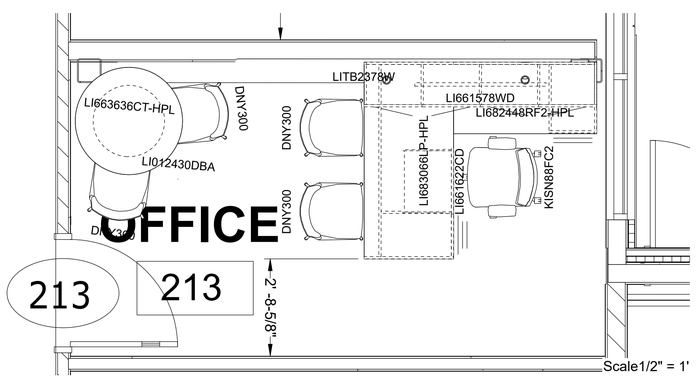
4/2/2025 3:22:14 PM Karinne Skazak

SHEET: 28/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
213 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448RF2-HPL	LI682448RF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Right File/File,48"Wx24"Dx30"H,HPL
9	1	LI683066LP-HPL	LI683066LP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Left,66"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 213 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

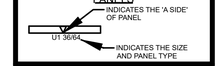
APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

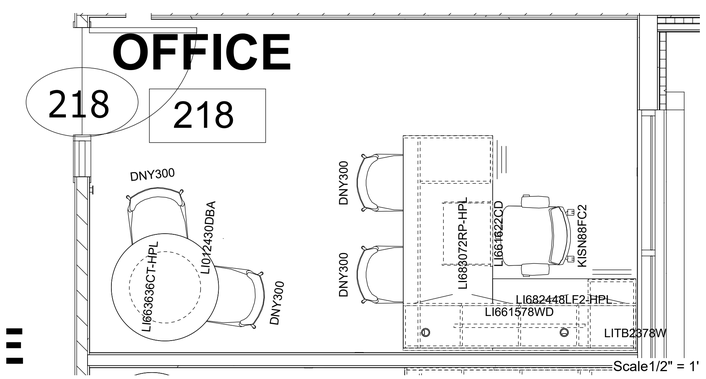
4/2/2025 3:22:15 PM Karinne Skazak

SHEET: 29/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
218 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448LF2-HPL	LI682448LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GL/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 218 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

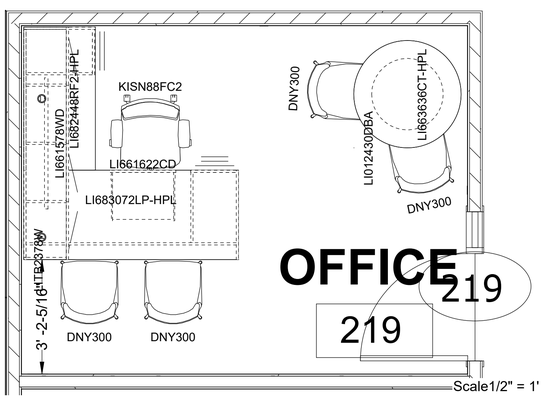
4/2/2025 3:22:16 PM Karinne Skazak

SHEET: 30/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
219 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448RF2-HPL	LI682448RF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Right File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072LP-HPL	LI683072LP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Left,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 219 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

LFI 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

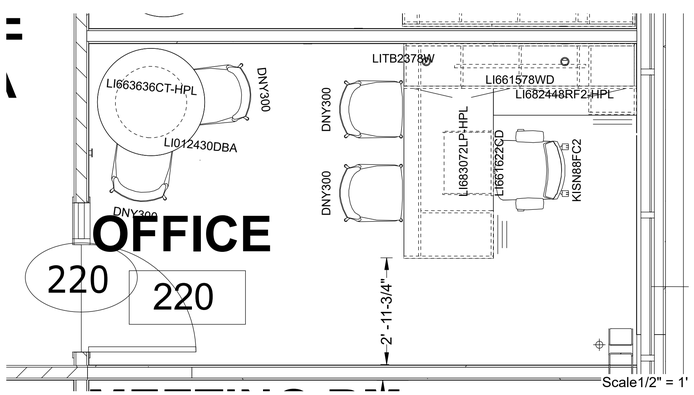
4/2/2025 3:22:17 PM Karinne Skazak

SHEET: FLOOR PLAN 31/41

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
220 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448LF2-HPL	LI682448LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GL/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 220 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

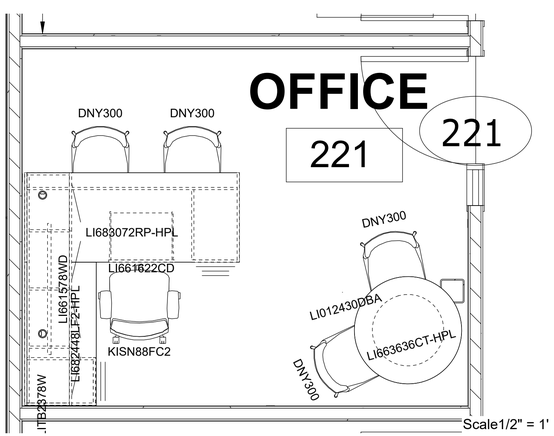
4/2/2025 3:22:17 PM Karinne Skezak

SHEET: 32/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
221 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448RF2-HPL	LI682448RF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Right File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072LP-HPL	LI683072LP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Left,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 221 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

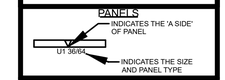
APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS



PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

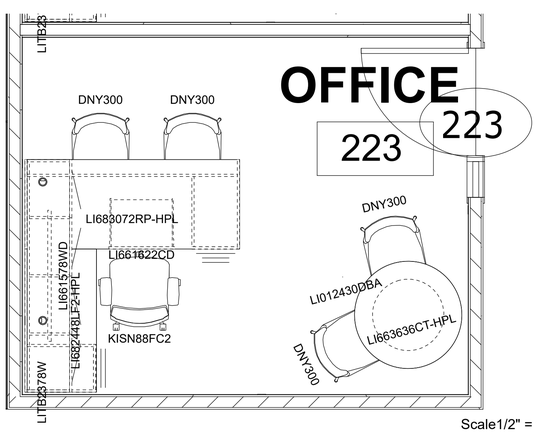
4/2/2025 3:22:15 PM Karinne Skazak

SHEET: 33/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
223 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448LF2-HPL	LI682448LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GL/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 223 OFFICE

BILL OF MATERIALS



Scale1/2" = 1'

FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:22:15 PM Karinne Skazak

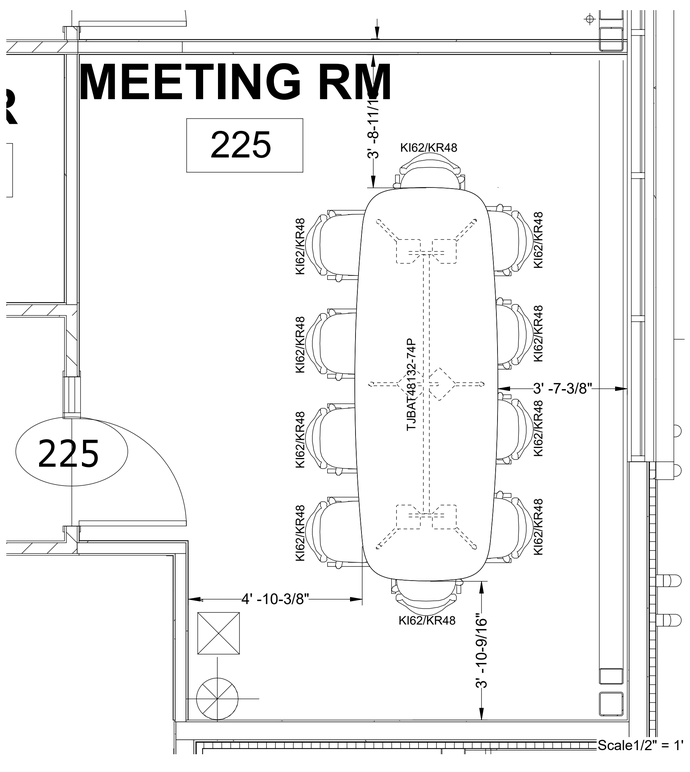
SHEET: FLOOR PLAN

34/41

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
225 MEETING ROOM					
1	10	KI62/KR48	KI62/KR48	/NF/DUB2/NFRGRPP1ADELE/27.243.104.P/S-NS/SLD	Impress Task,Pedestal Base,Fixed Loop Arms,Upholstered
2	1	TJBAT48132-74P	TJBAT48132-74P	/EITLAMG1LAMGRD1STD/LIT/NPA/BL/GLP/NNN	Tributaire, Conference,Boat,48x132", 29"H,74P edge
					Total 225 MEETING ROOM

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 35/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

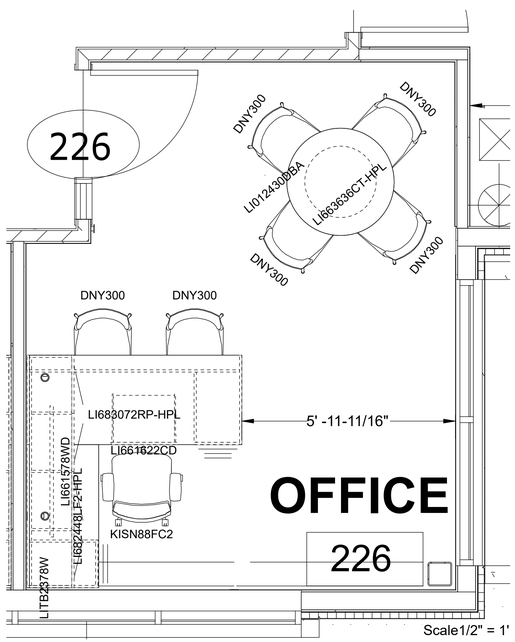
4/2/2025 3:22:15 PM Karinne Skezak

SHEET: 35/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
226 OFFICE					
1	6	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448LF2-HPL	LI682448LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GL/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 226 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

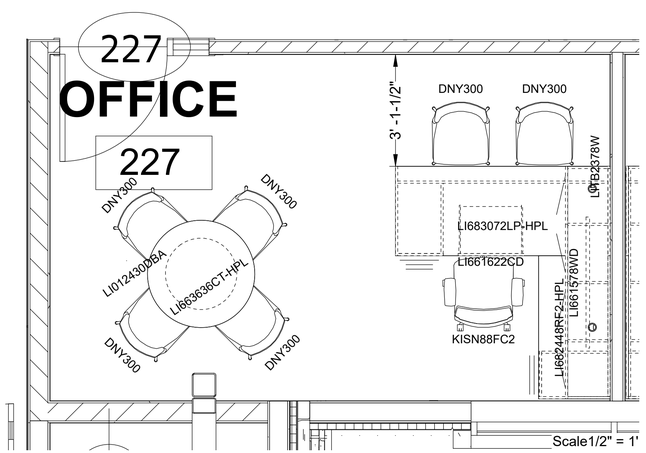
4/2/2025 3:22:20 PM Karinne Skazak

SHEET: 36/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
227 OFFICE					
1	6	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448RF2-HPL	LI682448RF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Right File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072LP-HPL	LI683072LP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Left,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 227 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

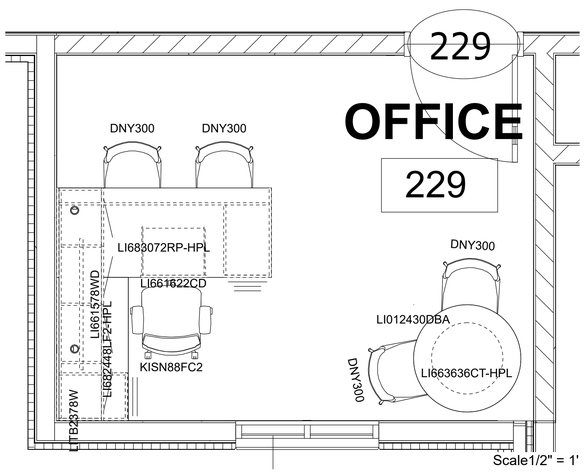
4/2/2025 3:22:20 PM Karinne Skazak

SHEET: 37/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
229 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448LF2-HPL	LI682448LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GL/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 229 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

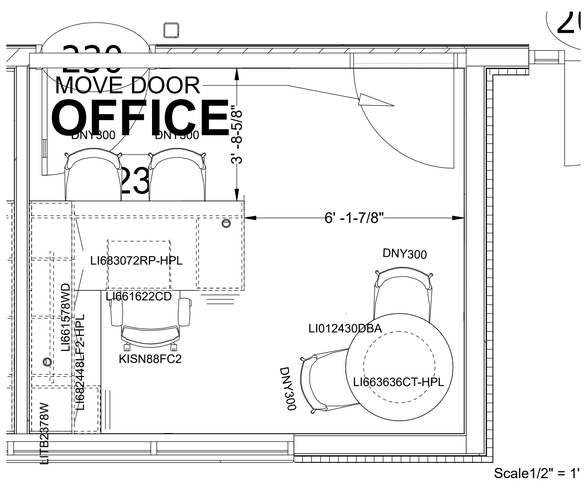
4/2/2025 3:22:21 PM Karinne Skezak

SHEET: 38/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
230 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448LF2-HPL	LI682448LF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Left File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072RP-HPL	LI683072RP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Right,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 230 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:22:23 PM Karinne Skazak

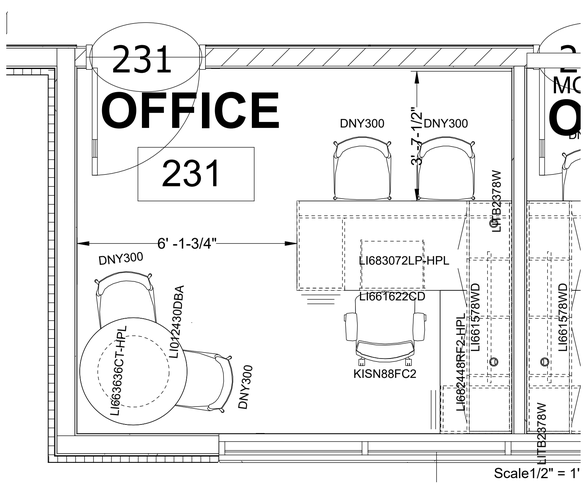
SHEET: FLOOR PLAN

39/41

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
231 OFFICE					
1	4	DNY300	DNY300	/-NFR/PCO/TBD/TBD/NFRGRPP1ALEA/27.293.136.P	Doni Tapered Steel Leg Armless Chair,Uph Seat/Back,Solid Color
2	1	KISN88FC2	KISN88FC2	/NLS/TBD/MSC/NFRGRPP1ALEA/27.293.136.P	Signia Advanced Synchrotilt Task Chair, Fabric Cushioned Back, 4D Arms
3	1		LEDTK.44.SGL.GN		Single Shelf/Cabinet LED Task Light,44"W, for 54" and Larger Overhead/Shelf
4	1	LI012430DBA	LI012430DBA		Likha Disk Table Base,for use with 36" and 42" Circular Table Top-Artic Silver,24"Dia.x27-3/4"H
5	1	LI661578WD	LI661578WD	/LSL/NL	Likha Hutch,Wall Mount,Four Laminate Doors,78"Wx15"Dx17-3/16"H
6	1	LI661622CD	LI661622CD	/LSL	Likha Center Drawer
7	1	LI663636CT-HPL	LI663636CT-HPL	/LSL/Y	Likha 36" Circular Table Top,HPL
8	1	LI682448RF2-HPL	LI682448RF2-HPL	/LPW/BLSL/AQD/Y/GC/BGRM/GAS/KS/AS	Likha Full Pedestal Return-Right File/File,48"Wx24"Dx30"H,HPL
9	1	LI683072LP-HPL	LI683072LP-HPL	/LPW/BLSL/AQD/Y/GR/GAS/KS/AS	Likha Single Pedestal Rectangular Desk w/Recessed Front-Left,72"Wx30"Dx30"H,HPL
10	1	LITB2378W	LITB2378W	/GRPV/RATTAN/28.069.064.P	Likha 23"H Tackboard,Attach below Wall Mount Hutch w/out Paper Slots,Fits 78"W"
					Total 231 OFFICE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF SITE CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

APPROVED AS NOTED ☐

REVISE AND RESUBMIT ☐

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

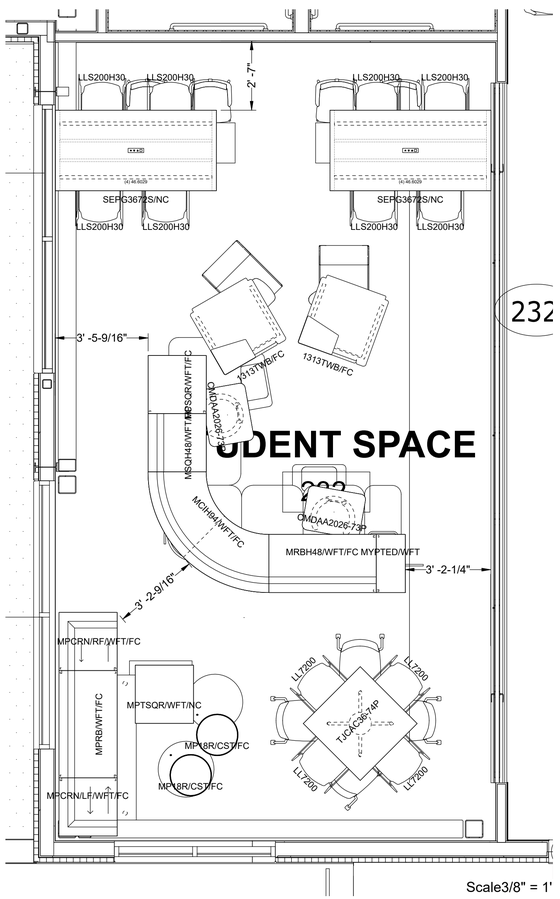
4/2/2025 3:22:23 PM Karinne Skazak

SHEET: 40/41 FLOOR PLAN

V24.1

#	Quantity	Ind. Tag	Part Number	Options	Description
232 STUDENT SPACE					
1	2	1313TWB/FC	1313TWB/FC	/H/NFRHFLOW/27.334.072.PNFRHFRIEZE/27.270.179.P/TBD/NAC/NMB/PNL/LFT/RA/NTP/TBD/TBD	Sela Lounge Chair Wood Base,Tablet Arm,Contrast
2	8	(4) 46.6029	46.6029		Serenade Gathering Table Bag Hook
3	2	CMDAA2026-73P	CMDAA2026-73P	/TBD/TBD/TBD	C-Table Max, 29" Fixed Height, Small Rectangle Top, 20"x26" worksurface, 73P edge
4	4	LL7200	LL7200	/-NFR/PCO/TBD/TBD/TBD	LimeLite High Density Armless Chair, Uph Seat/Poly Back
5	8	LLS200H30	LLS200H30	/-NFR/PCO/TBD/TBD/TBD	LimeLite High Density Armless Stool, Uph Seat/Poly Back, 30" High
6	1	MCIH94/WFT/FC	MCIH94/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Inside Back 90° Curve, 48" High-Back, Wood Feet, Contrast
7	2	MP18R/CST/FC	MP18R/CST/FC	/H/NFRHADELE/27.243.123.PNFRH/NMB	MyPlace 18" Round,2" Casters,Contrast
8	1	MPCRN/LF/WFT/FC	MPCRN/LF/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/NMB/TBD	MyPlace Corner w/Back,Left-Face Uph Dir,2" Wood Feet,Contrast
9	1	MPCRN/RF/WFT/FC	MPCRN/RF/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/NMB/TBD	MyPlace Corner w/Back,Right-Face Uph Dir,2" Wood Feet,Contrast
10	2		MPGANGKIT		MyPlace Ganger Kit
11	2		MPHBLBGANG		MyPlace High-Back to Low-Back Gangers
12	1	MPRB/WFT/FC	MPRB/WFT/FC	/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Rectangle w/Back,2" Wood Feet,Contrast
13	1	MPSQR/WFT/FC	MPSQR/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.082.P/NP/TBD/NMB	MyPlace 26" Square,2" Wood Feet,Contrast
14	1	MPTSQR/WFT/NC	MPTSQR/WFT/NC	/NFRHFLOW/27.334.072.P/TBD/TBD/TBD/NMB	MyPlace Square Table,2" Wood Feet,Non-Contrast
15	1	MRBH48/WFT/FC	MRBH48/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Rectangle with 48" High-Back, Wood Feet, Contrast
16	1	MSQH48/WFT/FC	MSQH48/WFT/FC	/H/NFRHADELE/27.243.072.PNFRHADELE/27.243.072.PNFRHADELE/27.243.123.P/NP/TBD/NMB	MyPlace Lounge Chair, 48" High-Back, Wood Feet, Contrast
17	1	MYPTED/WFT	MYPTED/WFT	/TBD/TBD/TBD/TBD/TBD	MyPlace Rectangular In-Line Table Without Pad, 2" Wood Feet
18	2	SEPG3672S/NC	SEPG3672S/NC	/ST/PMD1/TBD/TBD	Serenade Gathering Table,Non-contrast Laminate,Single Circuit,36x72"W,29"H
19	1	TJCAC36-74P	TJCAC36-74P	/TBD/TBD/NPA/SX/GLP/NNN	Tributaire, Cafe X-Base, Square,36", 29"H,74P edge
					Total 232 STUDENT SPACE

BILL OF MATERIALS



FLOOR PLAN

RENDERING

NOTE: DEFAULT FINISHES SHOWN

Actual colors and textures of final products may vary from the colors and textures shown

CONFIDENTIALITY

THIS PLAN IS THE CONFIDENTIAL PROPERTY OF KRUEGER INTERNATIONAL, INC. AND CONTAINS INFORMATION THAT IS NOT TO BE USED EXCEPT IN CONSIDERATION OF BIDS OR PROPOSALS TENDERED HEREWITH. REPRODUCTION OR

PURCHASER DOES NOT INTEND TO MAKE THIS ANNEXATION A PERMANENT ACCESSION TO REAL

CODE REQUIREMENTS

THIS PLAN IS BASED UPON KI'S INTERPRETATION OF APPLICABLE SECTIONS OF THE 2018 INTERNATIONAL BUILDING CODE (IBC) AND INFORMATION PROVIDED BY OWNER/ARCHITECT/CONTRACTOR, WHICH INFORMATION IS PRESUMED BY KI TO BE ACCURATE WITHOUT INDEPENDENT INVESTIGATION. NOTWITHSTANDING ANYTHING TO THE CONTRARY NOW OR HEREAFTER STATED IN ANY CONTRACT TO WHICH KI IS A PARTY, KI DISCLAIMS ANY RESPONSIBILITY OR LIABILITY TO INSURE THAT THIS PLAN COMPLIES WITH ANY OTHER FEDERAL, STATE OR LOCAL STATUE, REGULATION OR CODE SECTION APPLICABLE TO THE PROJECT, PROJECT SITE, OR KI'S WORK, REGARDLESS OF WHETHER KI MAY BE ADVISED OF THE SAME. APPROVAL OF THIS PLAN SHALL INCLUDE AGREEMENT TO THE FOREGOING. KI RECOMMENDS THAT THESE PLANS AND THE RESULTING LAYOUTS BE REVIEWED WITH A LOCAL FIRE INSPECTOR TO VERIFY COMPLIANCE WITH ALL LOCAL BUILDING CODES. KI DISCLAIMS

FIELD VERIFICATION

THIS PLAN INCORPORATES BUILDING INFORMATION COMPILED FROM VARIOUS SOURCES ASSOCIATED WITH THIS PROJECT AND DEEMED AS RELIABLE. CONDITIONS DIRECTLY AFFECTING THE PRODUCT OR IT'S INSTALLATION

BUILDING VERIFICATION

TO ENSURE PROPER FIT OF FURNITURE VERIFY: WALLS, COLUMNS, WINDOWS, DOORS, WINDOW SILL HEIGHTS, ALL WALL FEATURES IE: THERMOSTATS, LIGHT SWITCHES, ELECTRICAL, HVAC, FIRE EXTINGUISHERS, ALARMS

DRAWING REVIEW

THESE PLANS ARE INTENDED TO COMPLY WITH THE CONTRACT. AS SUCH, THESE PLANS MUST BE REVIEWED BY THE OWNER/ARCHITECT/CONTRACTOR, OR OTHER APPROPRIATE REPRESENTATIVE. IF KI IS TO PROCEED WITH PRODUCT INSTALLATION IN ACCORDANCE WITH THESE PLANS, MARK THE "APPROVED AS NOTED" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETUN THIS DOCUMENT TO KI. IF THESE PLANS ARE TO BE CORRECTED, MARK THE "REVISE AND RESUBMIT" BOX BELOW, EXECUTE AND COMPLETE THE INFORMATION AT THE BOTTOM OF THIS PAGE, AND RETURN THIS DOCUMENT TO KI. AUTHORIZED SIGNATURE INDICATED REVIEW OF THESE PLANS. BELOW SIGNATURE, PRINT NAME, TITLE, COMPANY OR AFFILIATION, AND DATE. MANUFACTURE OF PRODUCT SHOWN IS NOT SCHEDULED UNTIL DRAWING REVIEW IS COMPLETE AND AUTHORIZED SIGNATURE IS RECEIVED. IT IS THE OWNER/ARCHITECT/CONTRACTOR'S RESPONSIBILITY TO NOTIFY KI IF ARE NOT CONDITIONS HAVE CHANGED OR ARE NOT DEPICTED ON OUR DRAWING THAT WOULD IMPACT OUR FURNITURE LAYOUT AFTER COMPLETED FIELD VERIFIED DIMENSIONS HAVE BEEN OBTAINED.

☐ APPROVED AS NOTED

☐ REVISE AND RESUBMIT

SIGNATURE:

PRINT:

PANELS

INDICATES THE 'A SIDE' OF PANEL

U1 36/64

INDICATES THE SIZE AND PANEL TYPE

PROJECT TITLE:

Southeast New Mexico College: Trades + Tech Vocational Bldg

FLOOR/AREA:

ORDER #:

SALESFORCE #: 718801

DATE: 11/25/24

REVISIONS:

NO	DATE	BY	DESCRIPTION
1	12/31/2024	R2-KS	CHANGES PER DOC
2	01/23/2025	R3-KS	CHANGES PER DOC
3	02/05/2025	R4-KS	CHANGES PER DOCS/EM
4	02/18/2025	R5-KS	CHANGES PER JAIME EM
5	03/11/2025	CX	REV PER 3/11 PDF
6	04/01/2025	R7-KS	REV PER 25.03.27 DOC

DRAWN BY: KARINNE

SCALE: AS NOTED

DRAWING #: 718801_00_00_L07.cmdrw

4/2/2025 3:22:23 PM Karinne Slezak

SHEET: FLOOR PLAN

41/41

SECTION 12 21 13

HORIZONTAL BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Horizontal blinds.

B. Related Sections:
1. Section 08 11 00 - Hollow Metal Doors and Frames; glazed openings.
2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts.
3. Section 08 44 13 - Glazed Aluminum Curtain Walls.

1.2 SYSTEM DESCRIPTION

A. Horizontal metal slat louver blinds installed at storefront, curtain wall, glazed openings, and mirrors manual control of raising and lowering by cord; blade angle adjustable by control wand. Horizontal blinds shall be Indicated as "HB" on the drawings.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include manufacturer's catalog cuts and data sheets, and installation instructions and data certifying blinds are lead-free.

C. Shop Drawings: Include details of attachment and schedule of each size and location.

1.4 QUALITY ASSURANCE

A. Measurements: Provide custom size blinds for the openings or mirrors in which they are to be installed. Take careful measurements of each opening so that the blinds will fit properly. Plan dimensions shall not be used. Verify head, jamb, and sill conditions.

B. All blinds shall be lead-free.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.

B. Deliver blinds wrapped and crated in a manner to prevent damage to components or marring of surfaces.

C. Store and protect products under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

D. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, or warping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Horizontal Blinds: 1" wide by 0.0085" thick slat type, with valance for each blind.

Product/manufacturer; one of the following:
Bali Classics Mini Blinds; Springs Window Fashions Division, Inc. Levolor 1" (25mm) Riviera Classic Blind; Levolor Corp.

2.2 MATERIALS AND FABRICATION

A. Horizontal Blinds:
1. Head channel shall be 0.025" thick Tomized steel with a plastic type coating. Channel shall be "U" shaped, approximately 1" high be 1-9/16" wide, with flanged edges at the top.
2. Slat supports shall be braided of polyester yarn. The vertical component shall have a diameter of not less than 0.045" nor greater than 0.066". Braiding shall be accurate to hold slats equally spaced, parallel and straight, and to assure proper tilt control and adequate overlay of slats. Provide 31 rungs per 2 feet of ladder, equally spaced. Distance between ladders shall not exceed 21". The horizontal component shall consist of not less than four cables interbraided with the vertical component.
3. Slats shall be virgin aluminum alloy approximately 1" wide by 0.0085" thick. Slats shall have sufficient crown to prevent sagging and radius corners.
4. Bottom rail shall be 0.023" thick Tomized steel with a plastic type coating.
5. Tilter shall be Tomized steel of enclosed construction. Unit shall tilt the slats to any desired angle and hold them at that angle. An automatic disengagement of worm and gear shall eliminate overdrive to prevent strain or damage to wand, worm, gear, ladder or top slat. Operation shall be by wand of sufficient length and swivel for easy operation.
6. Lift cord shall be of adequate diameter, braided of high strength synthetic fibers.
7. Finish: The factory finish for the exposed surfaces shall be a plastic type finish coat baked on. Color shall be as scheduled.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive blinds for conditions which will adversely affect the installation of the blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Attach installation end brackets at each end of blind location. For blinds over 55" long or over 50 square feet in area, provide intermediate brackets.

B. Blinds shall be mounted in brackets inside frame jambs by skilled mechanics under the supervision of an authorized representative of the manufacturer. The completed blinds shall be left clean and in perfect working order. Crates, cartons, and rubbish shall be removed from the premises; rooms shall be left broom clean.

3.3 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4".

B. Maximum Offset From Level: 1/8".

3.4 ADJUSTING

A. Adjust work under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Adjust blinds for smooth operation.

3.5 CLEANING

A. Clean work under provisions of SECTION 01 74 13 - PROGRESS CLEANING.

END OF SECTION

SECTION 12 24 13

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Roll shades.

B. Related Sections:
   1. Division 26 - Electrical service and connection to motorized shades. Include custom switch plate.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 33 23 - Shop Drawings, Product Data, and Samples.

B. Product data for each type of shade specified. Include printed data on physical characteristics. Include warranty information.

C. Shop drawings showing location and extent of shades. Show installation details at and relationship to adjoining work. Include elevations indicating shade units. Indicate locations of shade controls.
   1. Motorized System: Provide shade assembly and mounting details, including detailed wiring diagrams and schematics.

D. Samples for Verification Purposes: One 18-inch-square sample of shade material for each color, texture, and pattern of shade required.

E. Submit manufacturer's maintenance data for shades.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has specialized in installing shades similar to those required for this Project.

B. Surface Burning Characteristics: Provide shades identical to those tested for the following fire performance characteristics as determined by testing identical products, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Field-Constructed Mockup: Prior to installing shades, prepare mockups for each form of construction and finish required to verify selections made under sample submittals, to demonstrate aesthetic effects and to establish application quality standards.

1.4 PROJECT CONDITIONS

A. Field Measurements: Check openings by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay in the work.

1.5 WARRANTY

A. Twenty-Five-year warranty on the following:
   1. Manually operated components.

2. Shade cloth, with provision that it will not deteriorate, sag or warp and will remain fit for use for the full warranty period.
3. Hardware components to be free from defects in material and workmanship under normal and proper use.

B. Five-year warranty on the following:
1. Motors.
2. Electronic components.

1.6 EXTRA MATERIALS

A. Extra Materials: Furnished from same production run as products installed, packaged with protective covering for storage, and identified with labels describing contents. Deliver extra materials to Owner.
1. Shades: Furnish quantity of full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Provide ElectroShade™ electrically operated, group switching, regular roll, pocket-mounted units, with shade cloth falling at window side of roller, as manufactured by MechoShade Systems, Inc. (phone 214- 585-0469) or approved equivalent.

B. Shadecloth shall meet requirements of Fed. Spec. CCC-C-521 E for fire retardency, NFPA 701 Small-Scale and/or NFPA 701 Large-Scale requirements. Antimicrobial without topical treatment. ASTM E-84: Flame Spread 17, Smoke Density Index 118, Shadecloth seconds or shadecloth manufactured using reprocessed materials are not acceptable.

C. Sunscreen Material: E c o G l a s s 2800 series 'Linen 2802' (0-1% openness) shadecloth at all areas. Color as scheduled.

2.2 MATERIALS AND FABRICATION

A. Components: Noncorrosive, self-lubricating materials.

B. Pockets/Blackout Channels/Snaploc™ Fascia:
1. Extruded aluminum pocket with exposed tile support and pocket closure with baked-enamel finish, MechoShade pocket #4123.
2. Accessibility by removing closure. No exposed screws or mounting means. Pocket shall be sized for a single shadeband.

C. Electrical Motors: UL approved, low-voltage motor with thermal overload switch. Each motor unit sized and provided by shade fabricator for installation indicated. The motor shall be tubular asynchronous and concealed. Internal limit switches shall be readily removable without having to remove the motor or the shade-tube assembly. Each window shall require a motor. Refer to electrical drawings for junction boxes and connections to digital key pads.

D. Installation Fasteners: Not less than two fasteners per bracket, fabricated from metal non-corrosive to shade hardware and adjoining construction and to support shades under conditions of normal use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings where shades will be installed prior to beginning installation. Verify that critical dimensions are correct and surface conditions acceptable.

1. Complete all finishing operations, including painting, before beginning installation.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install shades level and plumb in accordance with manufacturer's instructions and approved submittals, mounted not less than 1 inch from face of exterior glass.

B. Install metal parts isolated from concrete or mortar to prevent corrosion.

C. Install mounting brackets with at least two fasteners per bracket.

3.3 CLEANING

A. After completing the installation, clean shade surfaces according to the manufacturer's instructions.

B. Remove surplus materials, packaging, rubbish and debris resulting from the installation. Leave areas where installation occurred neat, clean, and ready for use.

END OF SECTION

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fabrication, finishing, and installation of standard fixed and mobile modular casework
2. Countertops
3. Sinks and Sink Accessories
4. Service Fixtures
5. Electrical fixtures that are integral with the casework
6. Utility Chase closure panels between cabinets and at exposed ends of utility chases

B. Related Sections and work performed by other trades:
1. Section 06 10 00 - Rough Carpentry: Furnishing and installing framing and blocking in walls, floors and ceiling to support equipment
2. Division 22 - Plumbing - Basic Mechanical Materials and Methods: Furnishing, installation and connection of traps, tailpieces, drain line and vents, service piping, in-line vacuum breakers, special plumbing fixtures, including any required supports, straps and or hangers.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Not less than 5 years' experience in the actual production of specified products. Casework shall be entirely manufactured and assembled in the USA. (American Made)
2. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC- accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Installer Qualifications: Firm with minimum 5 years' experience in installation or application of systems similar to those required for this Project and approved by this manufacturer.

1.3 SUBMITTALS

A. Submit shop drawings for all work furnished under this section. Drawings shall show size, arrangement, type of materials, and relationship to adjacent work.

B. Indicate blocking requirements for installing casework.

C. Finish selection - Submit finish color charts representing manufacturers full range of standard colors.

D. Upon completion of installation, and as a condition of acceptance, submit copies of warranty and maintenance.

E. LEED Submittal:
1. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

5. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.

1.4 PROJECT CONDITIONS FOR DELIVERY AND INSTALLTIQN

A. All wood or metal blocking (wall grounds) installed within the partitions to allow for immediate installation upon delivery.

B. Interior relative humidity not less than 40 percent, nor more that 60 percent.

C. Interior temperature to be not less than 65 degrees nor greater than 80 degrees.

D. All overhead work including grid/soffits, mechanical, electrical, or plumbing to be complete prior to delivery

E. All painting / finishing is to be complete prior to delivery of casework.

F. All wet operations to be complete prior to delivery of casework.

G. Overhead lighting to be installed and operating prior to delivery of casework

H. Concrete floors to be level within acceptable trade tolerances, within 1/8” of level per 10 foot run. Unacceptable gaps at floors due to this problem will not be the responsibility of the casework installer.

1.5 WARRANTY

A. Casework Manufacturer Warranty: 3 years from date of delivery.
   1. Warranty covers the products for defects in materials and workmanship.
   2. Within the warranty period, we shall, at our option, repair, replace, or refund the purchase price of the defective casework.

B. When notified in writing by the owner, manufacturer shall promptly investigate and address any deficiencies.

C. Casework manufacturer will not assume any responsibility, or compensation, for unauthorized repairs or labor.

D. The warranty with respect to products from another company sold by the casework manufacturer is limited to the warranty extended by that company.

E. Casework manufacturer shall provide, with the closeout documents, a Certificate of Warranty for its products.

PART 2 - PRODUCTS

2.1 MOBILE LAMINATE CASEWORK

A. LEED:
   1. Regional Materials: Wood products shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
   2. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
   3. Particleboard/MDF/Hardboard: Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

4. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. 3/4” Thermofused melamine, finished on both faces, 1” particleboard substrate with high pressure laminate. Finish as selected by Architect from manufacturers range of submitted colors.

C. Areas designated for handicap users shall comply with ADA standards.

D. Solid Surface Countertops: Fabricate restroom countertops to detail using 1/2” Corian Surfaces as manufactured by DuPont.
   1. Use seam adhesive and color -matched sealant by manufacturer
   2. Color shall be as selected by Architect from full range of manufacturer colors.
   3. Edge Treatment: Radiused post formed edges. PVC edging will not be acceptable.
   4. Substrate shall be medium density overlay fiberboard.

E. Plastic Laminate: General purpose grade, high pressure decorative laminate meeting the physical requirements of NEMA LD 3 and with a suede finish. Colors shall be as selected by Architect from manufacturer's full color and pattern range. Architect reserves the right to select one color for the exposed surfaces of the basic components of cabinets and a different color for the following components of cabinets: door and drawer fronts (including edges of door and drawer fronts), backs of open shelving, and countertop and backsplash, unless shown otherwise. Product/manufacturer; one of the following:
   1. Formica Brand Laminate; Formica Corp.
   2. Nevamar; Nevamar Co., LLC; Decorative Products Div.
   3. Wilsonart; Wilsonart International; Div. of Premark International, Inc.
   4. Pionite; Panolam Industries

F. Base Cabinets Materials:
   1. Ends panels, backs, partitions, dividers, bottoms, rails, will be 3/4” thermofused melamine, finished on both faces, on 451b particleboard substrate. All exposed edges to be edged with 2mm PVC matching edge band, machine applied with hot-melt adhesive.
   2. Adjustable shelves shall be 1” thermofused melamine on 451b particleboard substrate, finished on both faces and edgebanded with 2mm matching PVC.
   3. Individual tops are 1” 451b substrate with high pressure laminate applied to the top surface and have a balancing backer sheet applied to the bottom face. All exposed edges will be edge banded with 2mm matching PVC.
   4. Back and return splashes will be 3/4” 451b substrate with high pressure laminate applied to the one surface and have a balancing backer sheet applied to the bottom face. All exposed edges will be edge banded with 2mm matching PVC.
   5. Sub base will be 3/4” thermofused melamine
   6. Where shown, provide casters 3-1/2” concealed ball-bearing double raceway with 2001b capacity each
   7. Adjustable levelers zinc plated, load capacity 3301bs each, height adjustment 1-1/8” Hafele #637.23.900

G. Base Cabinet Construction:
   1. Bored, doweled, dadoed, glued and screwed construction.
   2. Cabinets are enclosed without the use of common partitions.
   3. Backs are flush and finished with matching laminate, bored, doweled and glued on three sides.
   4. Enclosed toe space 3” x 4” high is provided, with toe rail bored, doweled, and glued to end panels.
   5. Shelves are supported on heavy-duty stud type, spoon support with a non-mar, non-skid rubber cover which fit into holes drilled at 32mm centers into the case end panels for maximum stability and adjustability.
   6. Sub base will be CNC machined to accept and in caster plates. Sub-base facilitate the installation of casters and provide additional structural integrity.
   7. Adjustable levelers shall be provided in all four comers to adjust positioning and allow the cabinet to be secured to the floor until or if should need to relocated. Levelers must be fully accessible from inside the cabinet and pass through cabinet bottom and structural sub-bottom

H. Wall and Upper Cabinet Material:
   1. Ends panels, backs, partitions, dividers, tops, bottoms, adjustable shelves and rails, will be 3/4” thermofused melamine, finished on both faces, on 451b particleboard substrate. All exposed edges to be edged with 2mm PVC matching edge band, machine applied with hot-melt adhesive.

I. Wall and Upper Cabinet Construction:
   1. Top and bottom panels are bored, doweled, and glued to the end panels
   2. Shelves are supported on heavy-duty stud type, spoon support with a non-mar, non-skid rubber cover which fit into holes drilled at 32mm centers into the case end panels for maximum stability and adjustability.
   3. Wall cabinet backs are recessed and let into dadoed end panels, bored, doweled and glued into top and bottom panels

J. Tall Case Material
   1. Ends panels, backs, partitions, dividers, bottoms, rails, will be ¾” thermofused melamine, finished on both faces, on 451b particleboard substrate. All exposed edges to be edged with 2mm PVC matching edge band, machine applied with hot-melt adhesive.
   2. Adjustable shelves shall be 1” thermofused melamine on 451b particleboard substrate, finished on both faces and edgebanded with 2mm matching PVC.
   3. Sub base will be 3/4” thermofused melamine
   4. Casters 3-1/2” concealed ball-bearing double raceway with 2001b capacity each
   5. Adjustable levelers zinc plated, load capacity 3301bs each, height adjustment 1-1/8” Hafele #637.23.900

K. Tall Cabinet Construction:
   1. Bored, doweled, dadoed, glued and screwed construction.
   2. Cabinets are enclosed without the use of common partitions.
   3. Backs are flush and finished with matching laminate, bored, doweled and glued on three sides.
   4. Enclosed toe space 3” x 4” high is provided, with toe rail bored, doweled, and glued to end panels.
   5. Shelves are supported on heavy-duty stud type, spoon support with a non-mar, non-skid rubber cover which fit into holes drilled at 32mm centers into the case end panels for maximum stability and adjustability.
   6. Sub base will be CNC machined to accept and in caster plates. Sub-base facilitate the installation of casters and provide additional structural integrity.
   7. Adjustable levelers shall be provided in all four comers to adjust positioning and allow the cabinet to be secured to the floor until or if should need to relocated. Levelers must be fully accessible from inside the cabinet and pass through cabinet bottom and structural sub-bottom

L. Sink Base Cabinet Material
   1. Ends panels, backs and rails, will be 3/4” thermofused melamine, finished on both faces, on 451b particleboard substrate. All exposed edges to be edged with 2mm PVC matching edge band, machine applied with hot-melt adhesive.
   2. Individual tops are 1” 451b substrate with high pressure laminate applied to the top surface and have a balancing backer sheet applied to the bottom face. All exposed edges will be edge banded with 2mm matching PVC.
   3. Back and return splashes will be 3/4” 451b substrate with high pressure laminate applied to the one surface and have a balancing backer sheet applied to the bottom face. All exposed edges will be edge banded with 2mm matching PVC.

M. Drawer Box Material
   1. Drawer front is 3/4” thick hardwood plywood edged on 4 sides with 1 /8” solid wood.
   2. Drawer box front, sides, and back are 1/2” 9-ply hardwood plywood.
   3. Drawer bottom is 1/4" hardwood plywood.

N. Drawer Box Construction
   1. All four comers of the drawer box are dovetailed and glued.
   2. Top edges of the drawer box are radiused.
   3. Drawer bottom is let in on four sides.

2.2 CABINET HARDWARE

A. Hinges: Steel, Institutional type, 5 knuckle, ground hospital tip

B. Pulls: Solid metal, 4” wire

C. Door Catches Polyethylene friction roller with spring, metal strike plate, zinc coated

D. Drawer Slides
1. Epoxy coated steel with heavy duty nylon ball bearing rollers, 100 lb. load capacity.
2. Self-closing with positive stop to prevent accidental removal

E. Locks:
1. Laboratory grade, cylinder cam lock, with 5 disk tumbler mechanism
2. 200 available key changes with different, master and grandmaster keying systems possible

F. Shelf Clips: Heavy-duty stud type, spoon support with a non-mar, non-skid rubber cover

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that all Jobsite Conditions are met as listed in section 1.5 “PROJECT CONDITIONS FOR DELIVERY AND INSTALLATION.”

B. Advise General Contractor if these conditions are not met.

C. Coordinate the delivery and installation with the General Contractor and / or Owner.

3.2 INSTALLATION

A. Installation of casework and equipment to be plumb, level, true and straight. Use concealed shims as required.

B. If needed make adjustments to casework and hardware for smooth operation of doors and drawers, with no warp or bind.

C. Hand off all plumbing / electrical / or various other items to the appropriate subcontractors for assembly and installation.

PART 4 – FINISH SCHEDULE

4.1 FINISH SELECTION

A. Plastic Laminate:
1. Countertop
   Manufacturer: Wilsonart, Standard Laminate
   Color: Natural Cotton
   SKU #: 4946-38
   Finish: Fine Velvet Finish
   Manufacturer: Wilsonart, Standard Laminate
   Color: Raw Cotton
   SKU #: 4947-38
   Finish: Fine Velvet Finish
2. Clad Cabinets
   Manufacturer: Wilsonart, Standard Laminate

Color: Burnished Chesnut
SKU #: 4796-60
Finish: Matte Finish
Manufacturer: Wilsonart, Premium Laminate
Color: 5th Ave Elm
SKU #: 7966K-12
Finish: Softgrain Finish
AEON Scratch Resistance

B. Solid Surface

Manufacturer: Corian Solid Corian
Color: Sand Storm

4.2 LOCATIONS

A. Plastic Laminate 1:

Rooms: Reception 236, Office 200, Office 201, Office 210, Office 211, Office 213, Office 218, Office 219, Office 220, Office 221, Office 223, Office 226, Office 227, Office 230, Office 231.

B. Plastic Laminate 2:

Rooms: Classroom 101, Classroom 104, Classroom 110, General Classroom 204, General Classroom 205.

END OF SECTION

SECTION 123510.33

LABORATORY SERVICE CARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all Sections within Division 01 - General Requirements, which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

A. Section Includes: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Service modules with installed pre-fitted service utilities, in the following configurations.

    a. Service modules: provide in the following configurations

        1) Service wall ducts
        2) Service spines

            a) Wall-mounted
            b) Double-sided
            c) Bridge

        3) Overhead service carriers

            a) Service Wing
            b) Service Boom
            c) Service Column

        4) Service distribution terminals

2. Service Ceilings

    a. Manufacturer’s design assist for service ceiling system in accordance with Part 4 - Schedule for Service Ceiling Design Assist Services and requirements specified herein.

3. Service fittings.
4. Accessories.
5. Coordination with work of other sections.

B. Related Sections:

1. Section 055000 - Metal Fabrications, for Project utility supports to the extent not specified herein.
2. Section 061053 - Miscellaneous Rough Carpentry, for wood blocking for securing laboratory service carriers at concealed locations.

3. Section 115313 - Laboratory Fume Hoods, for fume hoods, including base cabinets and countertops under fume hoods, and service fittings.
4. Section 123553 - Laboratory Casework, for requirements for the following, to the extent not specified herein:

    a. Laboratory casework and casework accessories.

1.3 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of laboratory service carriers.

B. Coordinate installation of laboratory service carriers with installation of laboratory casework, fume hoods and other laboratory equipment.

1.4 REFERENCE STANDARDS

A. NCS (Natural Colour System), color reference system, NCS Colour GmbH, Unter den Linden 10, 10117 Berlin.

B. RAL, color matching system, German RAL gGmbH.

1.5 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1.6 SUBMITTALS

A. Action Submittals

1. Product data for each type of product.
2. Shop Drawings: For laboratory service carriers, including plans, elevations, and attachment details.

    a. Indicate types and configurations of service carriers.
    b. Indicate locations and types of service fittings.
    c. Indicate locations of blocking and reinforcements required for service carriers.
    d. Include details showing supports for service carriers, conduits and piping.
    e. Include details of exposed conduits, if required, for service fittings.
    f. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory casework and equipment.
    g. Include coordinated dimensions for laboratory equipment specified in other Sections.

3. Initial Selection Samples: For materials requiring color selection, per manufacturer's standard selection submittals.
4. Verification Samples: For each type service fitting.
5. Delegated-Design Submittal: For laboratory service carrier assemblies indicated to comply with performance requirements, including analysis data signed and sealed by the qualified professional structural engineer responsible for their preparation.

B. Informational Submittals

1. Evaluation Reports: For post-installed anchors, from ICC-ES.

C. Closeout Submittals

1. Maintenance Data: For laboratory service carrier assemblies, accessories and service fittings provided.

1.7 QUALITY ASSURANCE

A. Structural Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional structural engineer.

B. Professional structural Engineer Qualifications: A professional structural engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing structural engineering services of the kind indicated. Structural Engineering services are defined as those performed for installations of laboratory service carriers that are similar to those indicated for this Project in material, design, and extent.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory service carriers until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Locate concealed framing, blocking, and reinforcements that support laboratory service carriers by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Field Measurements: Where laboratory service carriers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating laboratory service carriers without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: WALDNER Laboreinrichtungen GmbH & Co. KG, Wangen, Germany, www.waldner.de & www.wnalabs.com

B. Contact Dustin Bauer at H2i Group as the supplier at dbauer@h2igroup.com – ph: (303-501-9824

C. Source Restriction: Provide laboratory service carriers, accessories and service fittings from same manufacturer, unless otherwise indicated.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional structural engineer to design laboratory casework and attachments to other work.

B. Structural Performance: Provide overhead laboratory service carriers, fasteners and utility service connections capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of components.

1. Seismic Performance: Laboratory service carriers and support framing system, including attachments to other work, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

a. Project Seismic Design Category: as indicated on Structural Drawings.
b. Component Importance Factor: [**1.0**] [**1.5**]

C. Corrosion Control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 MATERIALS

A. Sheet Metal - General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Extruded Aluminum Framing: Extrusions complying with ASTM B221 (ASTM B221M) or comparable standard, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper as recommended my manufacturer.

C. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A 879/A 879M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed.

1. Parts not powder coated: “Zincor” sheet steel according to DIN EN 10152:2017-06; Parts powder-coated: DC01/ST 1203 according to DIN EN10130:2007.

D. Steel Framing:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M or comparable standard. Steel Tubing: ASTM A 500/A 500M or comparable standard, cold-formed steel tubing.

E. Oriented Strand Board (OSB) Shelving: Provide in accordance with requirements of Section 123553 - Laboratory Casework, and as specified herein.

F. Glass Shelving: Provide in accordance with requirements of Section 123553 - Laboratory Casework, and as specified herein.

G. Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Structural Anchors: For applications indicated to comply with certain design loads, provide fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
2. Nonstructural Anchors: For applications not indicated to comply with design loads, provide fastener systems as recommended by manufacturer for installed condition.
3. Anchor Materials:

a. Zinc-Plated: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
b. Stainless Steel: Interior Stainless Steel: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M)
c. Plastic Anchors: Manufacturer's standards, as required for installed condition.

2.4 SERVICE MODULES

A. Service Wall Ducts: Modular service panel supply of services and duct add-on parts (accessories) at laboratory workstation.

1. Sizes: [**Provide in sizes as indicated on Drawings.**]

a. Widths: [**23.62 inches (600 mm)**][**35.43 inches (900 mm)**][**47.24 inches (1200 mm)**][**59.06 inches (1500 mm)**].
b. Depth: Ranging from 4.33 inches (110 mm) to 7.24 inches (184 mm) per configurations indicated.
c. Total Height: 9.92 inches (252 mm).
d. Panel Size: 11.81 inches (300 mm) by 7.67 inches (195 mm).

2. Construction:

a. Service panels shall be capable of being installed and removed without tools.
b. Service Module: With ingress protection rating (IP) of 44 per IEC 60529.
c. Cover Over Panel: Removable plastic enclosure with solid grade laminate 0.2 inches (5 mm) thick or glass plate, as indicated herein.

3. Panel Variations:

a. Plumbing/Gas: Panel with fittings for vacuum, gasses and/or water.

1) Maximum Number of Valves per Panel: 5
2) Maximum Number of pressure regulators per Panel: 3.

b. Electrical:

1) Supply: Receptacles in service panel.
2) [**Option**] Provide optional fuse box configured to minimize on-site installation by feeding one, three-phase conduit in lieu of several different circuits. Fuse box configuration shall segregate the electrical installation to minimize disruption of other electrical services.
3) Maximum Number of 125V Duplex Outlets per Panel: 3
4) Maximum Number of 250V Duplex Outlets per Panel: 3
5) Maximum Number of Automatic Circuit Breakers per Panel: 7 with AFDD.

B. Service Spines: Assembly for floor-supported services supply; modular attachment of add-on features such as reagent shelves, instrument shelves, suspended cabinets, and scaffold points; and installation of supplemental service duct add-on parts including pegboards, monitor arms, pipette holders, paper towel dispensers, and storage.

1. Configurations:

a. Wall-mounted
b. Double-sided
c. Bridge

2. Sizes: [**Provide in sizes as indicated on approved Shop Drawings.**]

a. Widths: [**23.62 inches (600 mm)**][**35.43 inches (900 mm)**][**47.24 inches (1200 mm)**][**59.06 inches (1500 mm)**][**70.87 inches (1800 mm)**].
b. Depth(s): As indicated on approved Shop Drawings.
c. Service Spine Assembly Height: 70.47 inches (1790 mm) with working surface height of 29.53 inches (750 mm) or 35.43 inches (900 mm), as indicated.
d. Support Pillar Heights:

1) Pillar Extension for Suspended Cabinets with Height of 18.11 inches (460 mm): 18.19 inches (462).
2) Pillar Extension for Suspended Cabinets with Height of 29.92 inches (760 mm): 30.0 inches (762).
3) Pillar Extension to Ceiling: Modified as required for ceiling height up to 137.8 inches (3500 mm), or 11.48 feet.

e. Reagent Shelving (Glass): Service spine width by 5.91 inches (150 mm) deep.
f. Instrument Shelf (OSB Shelf): Service spine width by 11.81 inches (300 mm) deep.

3. Construction:

a. Metal Components: Powder-coated steel.
b. Cover Over Panel: Removable plastic enclosure with solid grade laminate 0.2 inches (5 mm) thick or glass plate, as indicated herein.
c. End Panels: Provide melamine resin-faced panels as required to conceal exposed ends of service spine assemblies per configurations indicated.
d. Console Option: Service spine to provide services for mobile benches or stand-alone instruments.

4. Load Capacity:

a. Glass Shelf: 44.09 lbs. (20 kg)

b. Instrument Shelf: 66.14 lbs. (30 kg)

C. Service Bridge: Service supply for double-sided work benches, with modular attachment of optional, add-on features at function stands, including reagent shelves, instrument shelves, suspended cabinets, and scaffold points.

1. Configurations: Modular service panel ducts installed in configurations as indicated on Drawings.
2. Sizes: [**Provide in sizes as indicated on Drawings.**]

a. Widths: [**23.62 inches (600 mm)**][**35.43 inches (900 mm)**][**47.24 inches (1200 mm)**][**59.06 inches (1500 mm)**][**70.87 inches (1800 mm)**]
b. Depth(s): As indicated on approved Shop Drawings.
c. Height: 63.07 inches (1602 mm)
d. Height of Opening for Working Height of 35.43 inches (900 mm): 17.72 inches (450 mm).
e. Panel Size: 11.81 inches (300 mm) by 7.67 inches (195 mm).
f. Reagent Shelving (Glass): Service spine width by 5.91 inches (150 mm) deep.
g. Instrument Shelf (OSB Shelf): Service spine width by 11.81 inches (300 mm) deep.

3. Construction:

a. Panel and Carrier Assembly: Powder-coated steel panels with ingress protection rating (IP) of 44 per EN 60529.
b. Cover Over Panel: Solid grade laminate 0.2 inches (5 mm) thick.

4. Panel Variations:

a. Plumbing/Gas: Panel with fittings for vacuum, gasses and/or water.

1) Maximum Number of Valves per Panel: 5
2) Maximum Number of pressure regulators per Panel: 3.

b. Electrical:

1) Supply: Receptacles in service panel.
2) [**Option**] Provide optional fuse box configured to minimize on-site installation by feeding one, three-phase conduit in lieu of several different circuits. Fuse box configuration shall segregate the electrical installation to minimize disruption of other electrical services.
3) Maximum Number of 125V Duplex Outlets per Panel: 3
4) Maximum Number of 250V Duplex Outlets per Panel: 3
5) Maximum Number of Automatic Circuit Breakers per Panel: 7 with AFDD.

5. Load Capacity:

a. Reagent Repository: 44.09 lbs. (20 kg).
b. Instrument Shelf: 66.14 lbs. (30 kg).
c. Maximum Load per Scaffold Point with Scaffold Rod length of 11.81 inches (300 mm): 11.02 lbs. (5 kg).

2.5 SERVICE WING

A. General: Overhead services supply via the ceiling for laboratory benches and sinks, local exhaust equipment and fume hood, laboratory equipment on mobile tables, and floor-mounted laboratory equipment.

B. Configurations: Provide in the following configurations, as indicated on Drawings.

1. Expansion Stage 1: Service module enclosure with panels for electrical supply.
2. Expansion Stage 2: Service module enclosure with panels for electrical supply and tapered wing edges constructed as lights.
3. Expansion Stage 3: Service module enclosure with panels for electrical supply, tapered wing edges constructed as lights, and plumbing and air ducts.
4. Expansion Stage 4: Service module enclosure with panels for electrical supply, plumbing and air ducts, and wing edges constructed as add-on for plumbing and air ducts.

C. Service Wing Characteristics

1. Sizes: [**As indicated on Drawings.**]

a. Width(s): [**23.62 inches (600 mm)**][**35.43 inches (900 mm)**][**47.24 inches (1200 mm)**][**59.06 inches (1500 mm)**]
b. Depth at Expansion Stage 1: 9.45 inches (240 mm).
c. Depth at Expansion Stage 2: 19.53 inches (496 mm).
d. Depth at Expansion Stages 3 and 4: 29.53 inches (750 mm).
e. Height Without Dust Cover Expansion Stages 1 and 2 : 7.13 inches (181 mm).
f. Height Without Dust Cover Expansion Stages 3 and 4: 7.52 inches (191 mm).
g. Service Panel Dimensions (L,W,D): 11.81 inches (300 mm) by 8.66 inches (220 mm) 1.14 inches (29 mm).

2. Construction:

a. Braced Suspension Unit: Manufacturer's adjustable threaded rod and stainless steel rope (cable) braced hanging assembly with flexible tension for vibration prevention.
b. [**Optional incoming blade T-element.**]
c. Dust protection from overhead grid element; sheet metal cover attached to ceiling grid, color to match wing enclosure.
d. Wing Enclosure and Modular Service Panels Material: Powder-coated steel enclosure.

D. Services

1. Electrical: Provide electrical components in configurations as indicated on Drawings.

a. Electricity supplied by electrical enclosure with service panels in center of wing assembly.
b. Optional Connections: [**Telephone**][**computer**][**monitor**][**loud speaker**].
c. Lighting: [**Integrated in wing edges as direct and indirect lighting**][**downlight in electrical service panel**].
d. [**Optional fuse box**]

2. Plumbing Supply:

a. Service panel with fittings for [**vacuum**][**gases**][**water**].

b. Service supply lines and ventilation system.
c. [**Optional local extraction system.**]
d. [**Optional extract air connection for mobile fume hood (AeorEM).**]

2.6 SUSPENDED SERVICE BOOM

A. General:

1. Overhead services supply via the ceiling for laboratory benches, laboratory equipment on mobile tables, and floor-mounted laboratory equipment.
2. Modular attachment of service boom accessories on supporting structure.

B. Service Boom Characteristics:

1. Sizes: [**As indicated on Drawings.**]

a. Width(s): [**23.62 inches (600 mm)**][**35.43 inches (900 mm)**][**47.24 inches (1200 mm)**][**59.06 inches (1500 mm)**][**70.87 inches (1800 mm)**]
b. Depth Without Side Walls: 13.78 inches (350 mm).
c. Depth With Side Walls: 18.54 inches (471 mm).
d. Recommended Minimum Height of Bottom Edge of Suspended Service Boom to Finish Floor: 68.90 inches (1750 mm).
e. Maximum Height of Supporting Ceiling Construction: 157.48 inches (4000 mm).
f. Service Panel (W,H): 11.81 inches (300 mm) by 7.87 inches (200 mm).
g. Reagent Repository (W,H): Service boom width by 5.91 inches (150 mm).
h. Instrument Shelf (W,H): Service boom width by 11.81 inches (300 mm).

2. Construction:

a. Framing Supports: Powder-coated steel, color; sizes as indicated on approved Shop Drawings.

1) Ladder-type steel brackets, suspended from ceiling structure with intermediate horizontal bracing frame and vertical supply duct.
2) Steel lateral pillars attached to sides of ladder bracket to provide additional support for shelving and service modules at boom.

b. Instrument Shelf: Melamine resin coated OSB, 11.81 inches (300 mm) deep.
c. Reagent Repository: Glass shelf, 5.91 inches (150 mm) deep.
d. Service Panels: Powder-coated steel, with service fitting configurations as indicated.
e. Service Duct Cover: Solid grade laminate 0.2 inches (5 mm) thick.

3. Load Capacity: Maximum load capacity per component, as listed below.

a. Suspended Service Boom per Grid: 66.14 lbs. (30 kg).
b. Glass Shelf: 44.09 lbs. (20 kg).
c. Instrument Shelf: 66.14 lbs. (30 kg).
d. Load per scaffold Point With Scaffold Rod Length 11.81 inches (300 mm): 11.02 lbs (5 kg).

C. Services

1. Electrical: Receptacles (sockets) in service panel. [**Optional fuse box.**]

2. Plumbing: Service panel with taps and fittings for [**vacuum**][**gases**][**water**]. Supply lines in supply duct from above.

2.7 SERVICE COLUMN

A. General:

1. Overhead services supply via the ceiling for laboratory benches, laboratory equipment on mobile tables, and floor-mounted equipment.

B. Service Column Configurations: Provide in configurations as indicated on Drawings.

1. One-sided service columns.
2. Two-sided service columns.
3. Service columns suspended from ceiling structure.
4. Service columns suspended from service ceiling members.
5. Wall-mounted service columns.
6. Pairs of service columns with horizontal mounting rails for between column suspended cabinets and accessories.

C. Service Column Characteristics:

1. Sizes: [**As indicated on Drawings.**]

a. Width: 8.07 inches (205 mm).
b. Depth, Single-Sided: 5.51 inches (140 mm).
c. Depth, Double-Sided: 9.45 inches (240 mm).
d. Maximum Height of Supporting Construction: 177.17 inches (4500 mm).
e. Service Panel (W,H): 7.8 inches (200 mm) by 11.7 inches (300 mm).
f. Storage Width (Pairs of Columns with Horizontal Mounting Rails): [**24.02 inches (610 mm)**][**35.83 inches (910 mm)**][**47.64 inches (1210)**].
g. Storage Depth: 13.78 inches (350 mm).

2. Construction:

a. Column Enclosure and Service Panels: Powder-coated steel, with service fitting configurations as indicated.
b. Maximum Number of Service Panels per Side: 5
c. Vertical Framing Supports (Attachment to Ceiling Structure): Extruded aluminum profile, powder-coated, mounted to adjustable leveling plate anchor assembly at structural ceiling.
d. Column Enclosure Attachment (Attachment to Horizontal Framing Members of Service Ceiling): Direct attachment to framing members. Provide cover plate at face of service ceiling framing.
e. Horizontal Mounting Rails for Accessory Mounting: Vertically-adjustable aluminum extrusion attachment rails with anchor plates at ends for mounting on service column enclosures. Provide with the following accessories, where indicated.

1) Suspended (overhead) cabinets.
2) Splash guard.
3) Glass shelf with perimeter mounting frame.
4) <**insert additional service column accessory.**>

3. Maximum Load per Scaffold Point with Scaffold Rod Length of 11.81 inches (300 mm): 11.02 lbs. (5 kg).

D. Electrical Services: Supplied from above.

1. Electrical Supply: Receptacles (sockets) in panels.
2. [**Optional fuse box.**]

E. Plumbing Services: Supplied from above. Service panel with taps and fittings for [**vacuum**][**gases**][**water**].

2.8 SERVICE CEILING

A. General: Ceiling supply system for laboratories with flexible, modular layout, integrating all mechanical system trades in the lab room, including ventilation systems with control, electrical supply, lighting and services supply. Rectangular module grid constructed of extruded aluminum framing members, carrying service lines, electrical conduit runs, air supply duct, extract air duct and lighting systems as well as service modules and laboratory equipment.

1. Refer to Part 4 – Schedule for Design Assist Services for scope of manufacturer's services for design assist of service ceiling.

B. Service Ceiling Characteristics

1. Sizes: [**As indicated on Drawings.**]

a. Width and Depth: Adjusted to building grid.
b. Module Width: Recommended at 118.11 inches (3000 mm) – 149.61 inches (3800 mm).
c. Module Depth: Recommended at 94.49 inches (2400 mm) – 472.44 inches (12000 mm).
d. Recommended Height for Suspension System Unit: Bottom edge of service ceiling at 112.2 inches (2850).

2. Construction:

a. Rectangular Aluminum Framing Profiles: Provide as required to support grid loading and as indicated on approved Shop Drawings.

1) Sizes: [**1.97 inches (50 mm) by 1.97 inches (50 mm)**][**3.94 inches (100 mm) by 1.97 inches (50 mm)**][**3.94 inches (100 mm) by 3.94 inches (100 mm)**]

3. Maximum Load Capacity: 102.5 lbs./sq. ft. (500 kg/m^2).

C. Electrical Services:

1. Power supply components as determined by Design Assist process and as indicated on approved Shop Drawings.
2. Degree of Protection: IP 55.
3. Cabling: Cable duct to extra power and data route.
4. Fuse Box: Integrated into bus bar or service module.

D. Plumbing Services: Supply lines for [**vacuum**][**gases**][**water**].

1. Intersection-free and permitting retrofitting of all services.
2. Terminal Blocks: 2, 3 or 4 outlet couplings. Connections lockable under pressure (except for vacuum) via exposed pipes.
3. [**Optional cooling.**]

E. Ventilation:

1. Supply Air: Draft-proof supply air system as determined by Design Assist process and as indicated on approved Shop Drawings.
2. Extract Air: Extract air duct, elevated on ceiling grid with interfaces for fume hoods and other laboratory equipment requiring exhaust. [**Provide with optional extract air connections 9.84 inches (250 mm) and 3.54 inches (90 mm) in diameter.**]
3. Options as Determined by Design Assist Process:

   a. Sound attenuator module.
   b. Filter module.
   c. Airflow damper.
   d. VAV Module: Individual VAV for each special axis with inflow zone, airflow damper, heat exchanger and sound attenuator.

F. Lighting:

1. Light-Band System: As determined by Design Assist process and indicated on approved Shop Drawings.
2. Minimum 500 Lux.
3. [**Optional Lighting In Supply Air System: Textile-based supply air system.**]

2.9 LABORATORY WATER AND GAS SERVICE FITTINGS

A. Service Fittings: Provide fittings complete with washers, locknuts, nipples, and other installation accessories.

B. Materials: Cast or forged red brass, unless otherwise indicated.

1. Reagent-Grade Water Service Fittings: Polypropylene, or PVDF for parts in contact with water.

C. Finish: Acid- and solvent-resistant powder coating.

D. Water Valves and Faucets: Units with renewable seats; working pressure mas of 80 psig (550 kPa).

1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets or manufacturer's backflow preventers.
2. [**Option**] Aerators: Provide at non-serrated water fitting outlets. Aerators are available as an option, not as standard

E. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf (22 N) to operate. Provide units designed for working pressure up to 75 psig (520 kPa), with serrated outlets.

F. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig (280 kPa), with serrated outlets.

G. Steam Valves: Stainless-steel seat and PTFE seat disc. Provide units designed for steam working pressure up to 20 psig (140 kPa), with serrated outlets.

H. Needle Valves: Provide with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.

1. Provide units designed for working pressure up to [**60 psig (410 kPa)**] [**100 psig (690 kPa)**] [**125 psig (860 kPa)**].

Handles: Provide four-wing, [**molded-plastic**][**or powder-coated-metal**] handles for valves unless otherwise indicated.

1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
3. Provide heat-resistant plastic handles for steam valves.
4. Provide knurled, molded-plastic handles for needle valves.

2.10 ELECTRICAL[**AND COMMUNICATION**] SERVICE FITTINGS

A. Service Fittings, General: Provide units complete with metal housings, receptacles, switches, pilot lights,[**voice and data communication outlets,**] cover plates, accessories, and gaskets required for mounting on laboratory casework.

B. Receptacles (Sockets):

1. GFCI Receptacles: <**insert description**>
2. TVSS (Transient Voltage Surge Suppressor) Receptacles: Comply with UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

a. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and a minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
b. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
c. Identification: Distinctive marking on face of device to denote TVSS-type unit.

C. Switches: Comply with NEMA WD 1 and UL 20. Provide single-pole, double-pole, or three-way switches as required; rated 120 to 277-V ac; and in amperage capacities to suit units served.

1. Color of Switches: Manufacturer’s standard, unless otherwise indicated or required by NFPA 70.

D. Voice and Data Communication Outlets: Two RJ-45 jacks for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with [**Category 5e**] <**Insert category**>. Comply with UL 1863.

2.11 ACCESSORIES

A. Suspended (Overhead) Storage Cabinets: For mounting on horizontal support rails between service columns.

1. Provide in accordance with requirements of Section 123553 – Laboratory Casework and as specified herein.
2. Widths: [**As indicated on Drawings**][**24.02 inches (610 mm)**][**35.83 inches (910 mm)**][**47.64 inches (1210 mm)**].

B. Extraction Lever: Targeted exhaust extraction at work area, for mounting on service carriers. Provide in configurations, as indicated on the Drawings. [**Refer to Section 123553 - Laboratory Casework, for extraction levers mounted on service spines.**]

1. Dimensions: [**1.97 inches (50 mm)**][**2.95 inches (75 mm)**].

   a. Pipe Diameter: [**1.97 (50 mm)**][**2.95 inches (75 mm)**].
   b. Dome Hood Diameter: 13.78 inches (350 mm).
   c. Extraction Head Diameter: [**1.97 (50 mm)**][**2.95 inches (75 mm)**].

2. Construction:

   a. Piping: Anodized aluminum.
   b. Hinged Bracket: Polypropylene.
   c. Dome Hood: Polycarbonate.
   d. Extract Head: Anodized aluminum.

3. Ventilation:

   a. Minimum Volume Flow: 29.4 cfm (50 m^3/h).
   b. Primary Pressure: 0.022 psi (150 Pa).
   c. Primary Pressure with Waldner Air Flow Damper: 0.029 psi (200 Pa).

2.12 FABRICATION, GENERAL

A. Factory Assembly: Preassemble laboratory service carriers in manufacturer's factory to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Fabricate service carriers to permit future modifications of utility services without the use of special tools and without disrupting laboratory operations.

C. Fabricate service carriers to minimize connections to utility services on-site.

D. Coordinate dimensions and attachment methods of laboratory service carriers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.

E. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install laboratory service carriers.

2.13 FINISHES

A. Steel Powder Coat Finish:

1. Clean steel components in accordance with powder coating manufacturer's instructions.
2. Dry immediately in temperature-controlled environment.

3. Electrostatically deposit powder resin and immediately bake in temperature-controlled enclosure to ensure a smooth, hard finish.

B. Powder-coat finish steel in accordance with the following:

	Type A Polyester and Epoxy based resin - matt	Type B Polyester and Epoxy based resin - gloss	Type C Polyester and Epoxy based resin – high chemical resistance	Type D ECTFE coating
	(Duramix 33) SCALA light grey	Duramix 39 Anthrazit	Duraguard Anthrazit	Halar Black
thickness	3.1 mils (80 µm)	3.1 mils (80 µm)	3.1 mils (80 µm)	15.7 mils (400 µm)
Service Modules - Panels - Profiles - Accessories	 X X X			

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SERVICE MODULES, GENERAL

A. Install in accordance with manufacturer’s written instructions.

B. Service Spine: Secure to floor in accordance with approved Shop Drawings for installed condition. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and service spine assemblies.

3.3 INSTALLATION OF OVERHEAD CARRIER SYSTEMS

A. Install in accordance with manufacturer’s written instructions and as specified herein.

B. Install level, plumb, and true; using adjusting mounting hardware as required and in accordance with the following:

1. Variation of Bottoms of Service Carriers or Service Ceiling from Level: 1/16 inch in 10 feet (1.5 mm in 3 m).

C. Where service carriers are indicated as being attached to underside of ceiling structure, install with structural anchors approved for loading. Provide additional mounting hardware, in addition to manufacturer's standard mounting assemblies, as required to properly anchor support members to underside of structure.

D. Where service carriers are indicated as being installed on partitions, coordinate locations of wood blocking or additional framing as required for a secure installation of wall-mounted laboratory service carriers.

3.4 INSTALLATION OF LABORATORY ACCESSORIES

A. Install accessories according to approved Shop Drawings and manufacturer's written instructions.

B. Suspended Cabinets: Fasten to cabinet framing (scaffolding) or substrate as required to conform with seismic performance requirements.

C. Where accessories are partition-braced, securely fasten to partition framing, wood blocking, or reinforcements in partitions.

D. At service modules, coordinate accessory cut-outs and attachment to service duct panels.

3.5 INSTALLATION OF SERVICE FITTINGS

A. Pre-install service fittings to the greatest extent possible.

B. Install fittings according to approve Shop Drawings and manufacturer's written instructions.

3.6 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect laboratory service carriers during construction with 6-mil (0.15-mm) plastic or other suitable water-resistant covering.

C. Touch minor finish damage as required to match original finish. Remove and replace laboratory service carrier components if finish cannot be repaired to eliminate evidence of damage.

PART 4 - SCHEDULE FOR SERVICE CEILING DESIGN ASSIST PROCESS

4.1 DESIGN ASSIST SCOPE

A. Upon written authorization to proceed from the Construction Manager, laboratory service ceiling manufacturer shall furnish all labor, management, supervision and engineering input required to provide Design Assist services through construction documents for service ceiling assemblies,

as indicated below. The Scope of the Work includes, but is not necessarily limited to, the following in conformance with requirements specified hereinabove:

1. Design Input: Engineering support to the project team, including the Architect, engineering consultants, Owner and Construction Manager, to develop their basic design concepts for the work of this Section.
2. Continuing support to the Architect and engineering consultants for the development of the design and specifications for the service ceiling and related accessories, from the level of development included in manufacturer's proposal, through issuance of Construction Documents (CD's).
3. Reserve a place in manufacturer's engineering and production schedules for the work of fabricating, transporting and erecting the service ceiling so as to comply with Project schedule requirements.
4. Laboratory service ceiling components include, but are not necessarily limited to, the following:

    a. Electrical:

        1) Electrical supply and distribution throughout the service ceiling.
        2) Cabling ducts for electrical power and data route.

    b. Plumbing: Supply and distribution, inclusive of [**vacuum**][**gases**][**and water**].
    c. Ventilation:

        1) Design recommendations for air supply aeration systems (e.g. laminar flow, wavedrall, textile-based).
        2) Extract air design and coordination with laboratory equipment locations.
        3) Recommendations for optional ventilation requirements, including sound attenuator modules, filter modules, airflow dampers, VAV modules, and room control.

    d. Lighting: Design recommendations for service ceiling light-band system.
    e. All engineering work is subject to review and approval by Project's Architect and Engineers of Record.
    f. Structural engineering of system loading to ensure adequate support and anchorage of service ceiling and attached services.
    g. CAD copies of all work, in format and software version as required by the Architect.
    h. Incorporation of approved submittals into Project Building Information Model.
    i. Copies of design at designated milestone document issues suitable for incorporation into the design documents.

5. All work is subject to review and approval by Architect for appearance (aesthetics).
6. Design Assist Deliverables will include the following:

    a. Construction Design Drawings, hard copies and electronic files in format specified by the Owner and/or Architect.
    b. Mockup designs, approved by the Architect.
    c. Method statement for Shop Drawings, Production, and Execution of the work.
    d. Structural calculations by a qualified structural engineer, attesting to compliance with Code and design performance requirements.
    e. Work schedule, including Shop Drawings, procurement, fabrication durations, field measurement requirements, shipping durations, set up and erection activities, modified from time to time to reflect changes in Construction Manager's progress schedule.

END OF SECTION 123510.33

SECTION 123553.13

METAL LABORATORY CASEWORK & FUME HOODS

Part 1 Bench-Top Fume Hoods:

A. General: Ducted extraction of fumes, aerosols and dusts from internal workspace, with service outlets in back of wall (baffle) of internal workspace and operating controls located externally across the front of unit (traverse).

B. Configurations: as indicated on Drawings.

1. Supporting Structure: Self-supporting under-bench units, H-frame with pushed-in under-bench units
2. Airflow Control: FAZ- Function indicator.

C. Operational Features: Units shall include the following.

1. Window sash handle exhaust.
2. Automatic sash.
3. Airflow indicator and alarm.
4. Sash alarm.
5. Sash stops, with manual override.

D. Sizes: 1500mm wide

a. Width(s) and Corresponding (Approximate) Weights (with liner phenolic resin): 59.06 inches (1500 mm) by 859 lbs. (390 kg)
b. Interior Effective Width: 57.09inches(1450 mm)
c. Depth: 35.43 inches (900 mm).
d. Height: 106.3 inches (2700 mm, from the floor).
e. Interior Effective Height: 61.02 inches (1550 mm, from countertop).
f. Working Height: 35.43 inches (900 mm).

2. Construction:

a. Material Facing:

1) Worktop: Stoneware, industrial ceramic.

2) Internal Lining: Solid grade laminate, HPL high pressure laminate.

b. Sashes: Glass, horizontal sliding: 2 each for 59.06 inch (1500 mm) wide units. Fixed, upper window sash.
c. Control Panel: Functional indicator FAZ
d. Side Panel Options: Glazed side panel, side where indicated; Cable pass-through, side where indicated.
e. Removable front filler panel.
f. Maximum Receptors for Scaffold Points: 9 each 59.06 inch (1500 mm) wide FH.

1) Scaffold Rod (monkey bars) Diameter: 1/2 inch (12 mm nominal).

g. Maximum Load per Scaffold Point with Scaffold Rod Length of 11.81 inches (300 mm): 11.02 lbs. (5 kg).
h. Service Modules: 2 each at 59.06 inch (1500 mm) wide FH.

E. Services

1. Electrical:

a. Power outlets on the exterior service panels and interior service modules.
b. [Optional fuse box.]
c. [Optional SC sash controller.]

2. Plumbing Supply (Optional):

a. [Optional service module with fittings for vacuum, gas and water with integrated polypropylene cupsink.]
b. [Optional service module with fittings for vacuum, gas and water without integrated polypropylene cupsink.]

3. Ventilation:

a. Ventilation Type: [Constant volume with FAZ]
b. ASHRAE 110 As-Manufactured (AM) Rating: AM 0.05 (0.05 ppm).
c. Minimum Volume Flow: 353.2 cfm (600 m^3/h) at 59.06 inch (1500 mm) wide unit.
d. Airflow Monitoring System: FAZ.
e. Airflow Regulator System: by others.
f. Connection Point Level for FAZ with Exhaust Extraction Manifold Diameter of 9.84 inches (250 mm): 107.09 inches (2720 mm) from the floor.
g. Connection Point Level for FAZ with Exhaust Extraction Manifold Diameter of 12.40 inches (315 mm): 112.20 inches (2850 mm) from the floor.
h. [Optional under-bench exhaust extraction.]

1.2 OPERATIONAL FEATURES

A. Window Sash Handle With Air Exhaust Function: When sash is open, air flows into workspace preventing pollutant backflow out of fume hood. Sash operating mechanism, including release of sash stop, can be operated with one hand at any point along the sash.

B. Airflow Indicator and Alarm: Manufacturer's standard airflow indicator with audible and visual alarm that activates when airflow sensor reading is outside of preset range.

C. Sash Alarm: Provide fume hoods with an audible and visual alarm that activates when sash is opened beyond preset position.

1. Provide with silence and test switches.
2. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 18 inches (according to ASHRAE 110) or 500 mm (according to EN14175). Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood

1.3 FABRICATION, GENERAL

A. Factory Assembly: Preassemble laboratory service carriers in manufacturer’s factory to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Coordinate dimensions and attachment methods of laboratory service carriers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.

C. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install laboratory service carriers.

1.4 FINISHES

A. Steel Powder Coat Finish:

1. Clean steel components in accordance with powder coating manufacturer’s instructions.
2. Dry immediately in a temperature-controlled environment.
3. Electrostatically deposit powder resin and immediately bake in temperature-controlled enclosure to ensure a smooth, hard finish.

B. Powder-coat finishes steel in accordance with the following:

	Type A Polyester and Epoxy based resin - matt	Type B Polyester and Epoxy based resin - gloss	Type C Polyester and Epoxy based resin - high chemical resistance	Type D ECTFE coating

	(Duramix 33) SCALA light grey	Duramix 39 Anthrazit	Duraguard Anthrazit	Halar Black
Thickness	3.1 mils (80 µm)	3.1 mils (80 µm)	3.1 mils (80 µm)	15.7 mils (400 µm)
Bottom unit Panels frame	 X X			
Head unit of fume hood (not SI3-TA) Panels (under Benchtop) Profiles/ sash/ Panels (Panels on side) Airfoil	X	X	X	
Head unit pf Special appl. Fume Hood for acid digestion/ Perchloric Acid/ HF Panels (under Benchtop) Profiles/ sash Airfoil	X	X		X

Part 2 Service Spines for workbenches

1. Service modules with installed pre-fitted service utilities, in the following configurations.

    a. Service modules: provide in the following configurations

        1) Service wall ducts
        2) Service spines

            a) Wall-mounted
            b) Double-sided
            c) Bridge

- Service Spines: Assembly for floor-supported services supply; modular attachment of add-on features such as reagent shelves, instrument shelves, suspended cabinets, and scaffold points; and installation of supplemental service duct add-on parts including pegboards, monitor arms, pipette holders, paper towel dispensers, and storage.

    Configurations:

    b. Wall-mounted
    c. Double-sided

    Sizes:

d. Widths: [**23.62 inches (600 mm)**][**35.43 inches (900 mm)**][**47.24 inches (1200 mm)**][**59.06 inches (1500 mm)**][**70.87 inches (1800 mm)**].
e. Depth(s): As indicated on approved Shop Drawings.
f. Service Spine Assembly Height: 70.47 inches (1790 mm) with working surface height of 29.53 inches (750 mm) or 35.43 inches (900 mm), as indicated.
g. Support Pillar Heights:

1) Pillar Extension for Suspended Cabinets with Height of 18.11 inches (460 mm): 18.19 inches (462).
2) Pillar Extension for Suspended Cabinets with Height of 29.92 inches (760 mm): 30.0 inches (762).
3) Pillar Extension to Ceiling: Modified as required for ceiling height up to 137.8 inches (3500 mm), or 11.48 feet.

h. Reagent Shelving (Glass): Service spine width by 5.91 inches (150 mm) deep.
i. Instrument Shelf (OSB Shelf): Service spine width by 11.81 inches (300 mm) deep.

2. Construction:

a. Metal Components: Powder-coated steel.
b. Cover Over Panel: Removable plastic enclosure with solid grade laminate 0.2 inches (5 mm) thick or glass plate, as indicated herein.
c. End Panels: Provide melamine resin-faced panels as required to conceal exposed ends of service spine assemblies per configurations indicated.
d. Console Option: Service spine to provide services for mobile benches or stand-alone instruments.

3. Load Capacity:

a. Glass Shelf: 44.09 lbs. (20 kg)
b. Instrument Shelf: 66.14 lbs. (30 kg)

1.5 LABORATORY WATER AND GAS SERVICE FITTINGS

A. Service Fittings: Provide fittings complete with washers, locknuts, nipples, and other installation accessories.

B. Materials: Cast or forged red brass, unless otherwise indicated.

1. Reagent-Grade Water Service Fittings: Polypropylene, or PVDF for parts in contact with water.

C. Finish: Acid- and solvent-resistant powder coating.

D. Water Valves and Faucets: Units with renewable seats; working pressure mas of 80 psig (550 kPa).

1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets or manufacturer's backflow preventers.
2. [**Option**] Aerators: Provide at non-serrated water fitting outlets. Aerators are available as an option, not as standard

E. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf (22 N) to operate. Provide units designed for working pressure up to 75 psig (520 kPa), with serrated outlets.

F. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig (280 kPa), with serrated outlets.

G. Steam Valves: Stainless-steel seat and PTFE seat disc. Provide units designed for steam working pressure up to 20 psig (140 kPa), with serrated outlets.

H. Needle Valves: Provide with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.

1. Provide units designed for working pressure up to [**60 psig (410 kPa)**] [**100 psig (690 kPa)**] [**125 psig (860 kPa)**].

Handles: Provide four-wing, [**molded-plastic**][**or powder-coated-metal**] handles for valves unless otherwise indicated.

1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
3. Provide heat-resistant plastic handles for steam valves.
4. Provide knurled, molded-plastic handles for needle valves.

1.6 ELECTRICAL[**AND COMMUNICATION**] SERVICE FITTINGS

A. Service Fittings, General: Provide units complete with metal housings, receptacles, switches, pilot lights,[**voice and data communication outlets,**] cover plates, accessories, and gaskets required for mounting on laboratory casework.

B. Receptacles (Sockets):

1. GFCI Receptacles: <**insert description**>
2. TVSS (Transient Voltage Surge Suppressor) Receptacles: Comply with UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

   a. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and a minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
   b. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
   c. Identification: Distinctive marking on face of device to denote TVSS-type unit.

C. Switches: Comply with NEMA WD 1 and UL 20. Provide single-pole, double-pole, or three-way switches as required; rated 120 to 277-V ac; and in amperage capacities to suit units served.

1. Color of Switches: Manufacturer’s standard, unless otherwise indicated or required by NFPA 70.

D. Voice and Data Communication Outlets: Two RJ-45 jacks for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with [**Category 5e**] <**Insert category**>. Comply with UL 1863.

1.7 ACCESSORIES

A. Suspended (Overhead) Storage Cabinets: For mounting on horizontal support rails between service columns.

1. Provide in accordance with requirements of Section 123553 – Laboratory Casework and as specified herein.
2. Widths: [**As indicated on Drawings**][**24.02 inches (610 mm)**][**35.83 inches (910 mm)**][**47.64 inches (1210 mm)**].

1.8 FABRICATION, GENERAL

A. Factory Assembly: Preassemble laboratory service carriers in manufacturer's factory to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Fabricate service carriers to permit future modifications of utility services without the use of special tools and without disrupting laboratory operations.

C. Fabricate service carriers to minimize connections to utility services on-site.

D. Coordinate dimensions and attachment methods of laboratory service carriers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.

E. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install laboratory service carriers.

1.9 FINISHES

A. Steel Powder Coat Finish:

1. Clean steel components in accordance with powder coating manufacturer's instructions.
2. Dry immediately in temperature-controlled environment.
3. Electrostatically deposit powder resin and immediately bake in temperature-controlled enclosure to ensure a smooth, hard finish.

B. Powder-coat finish steel in accordance with the following:

	Type A Polyester and Epoxy based resin - matt	Type B Polyester and Epoxy based resin - gloss	Type C Polyester and Epoxy based resin – high chemical resistance	Type D ECTFE coating

	(Duramix 33) SCALA light grey	Duramix 39 Anthrazit	Duraguard Anthrazit	Halar Black
thickness	3.1 mils (80 µm)	3.1 mils (80 µm)	3.1 mils (80 µm)	15.7 mils (400 µm)
Service Modules - Panels - Profiles - Accessories	 X X X			

Part_3_Cabinets:

1.10 MATERIALS

A. Particleboard: ANSI A208.1, Grade M-2; ANSI A208.1, Grade M-2 or comparable standard, Exterior glue at worktops (countertops).

B. Oriented Strand Board (OSB): DOC PS 2, Exposure 1 or comparable standard.

C. Phenolic Resin Panels: Compact, solid grade laminate in thicknesses from 6-20 mm, complying with NEMA LD 3, Grade CGS, or comparable standard.

D. Melamine-Faced Panels: Particleboard or medium-density fiberboard faced with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, or comparable standard.

E. Edging for Melamine-Faced Panels: 0.08 inch (2 mm) thick, polypropylene edging matching melamine-faced panels.

F. Adhesives: Containing no urea formaldehyde.

G. Glass: Provide manufacturer's standard glass, complying with the following requirements.

1. Surface Compression: In range of 85 to 100 MPa.
2. Mechanical (Bending) Strength: 120 MPa.
3. Glass Types:

   a. Tempered: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3 or comparable standard; not less than 0.2-inch (5 mm) thick.
   b. Laminated: Clear laminated tempered glass complying with ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality-Q3 or comparable standard; with two plies not less than 0.2-inch (5 mm) thick and with clear, polyvinyl butyral interlayer.

4. Grind smooth and polish exposed glass edges and corners.

5. Safety glass shall be permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

H. Sheet Metal - General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

I. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, exposed or electrolytic zinc-coated, ASTM A 879/A 879M, with steel sheet substrate complying with ASTM A 1008/A 1008M, commercial steel, exposed.

1. Parts not powder coated: “Zincor” sheet steel according to DIN EN 10152:2017-06; Parts powder-coated: DC01/ST 1203 according to DIN EN10130:2007.

J. Steel Framing:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M. Steel Tubing: ASTM A 500, cold-formed steel tubing, or comparable standard.

Finish: Powder-coated, as specified herein

LABORATORY CASEWORK CONSTRUCTION, GENERAL

A. Cabinet Design

1. Type: Flush overlay, square edge.
2. Drawer and door, when closed, shall rest against face of cabinet shell, creating a 0.79-inch (19 mm) overlay front with 0.12-inch (3 mm) reveal.
3. The outer drawer and door head shall overlap the inner head on all four sides to eliminate sharp raw edges of steel.
4. The exposed corners of the door and door shall be welded and ground smooth.

B. Each cabinet shall be complete so that units can be relocated at any subsequent time without requiring field application of finished ends or other such parts.

C. Provide hinge reinforcement in cabinet panels at all hinge locations.

D. Finish: Provide matching finish at interior and exterior of metal laboratory casework, as specified herein.

E. Minimum gages:

1. 0.8mm: Drawer bodies, shelves and sloping tops.
2. 1.0mm: Door fronts, ends, backs, and access panels, exterior/interior drawer fronts, interior door panels, scribing strips, filler panels, enclosures, security panels
3. 1.2mm: Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails, stretchers, case tops, bottoms, bases,
4. 1.6mm: Vertical posts, uprights, Drawer suspensions, drawer brackets, door and case hinge reinforcements and front corner reinforcements.
5. 3.0mm: Table leg corner brackets and gussets for leveling screws.

1.11 BASE CABINET CONSTRUCTION

A. End uprights shall be formed into not less than an angle formation at top, bottom, back and a 0.75-inch (19 mm) wide front channel formation. A pilaster shall be added to the inside front of the upright for cabinet and hinge reinforcement and shall be perforated for the support of drawer channels, intermediate rails, hinge screws, and shelf adjustment holes.

B. A 0.87-inch (22 mm) high top horizontal rail shall interlock with the flange at top of end panels for strength, but shall be flush at face of unit.

C. Intermediate rails shall be provided between doors and drawers, but shall not be provided between drawers unless made necessary by locks in drawers. Intermediate rails shall be recessed behind doors and drawer fronts, and designed so that security panels may be added as required.

D. Intermediate vertical uprights shall be furnished to enclose cupboards when used in a unit in combination with a half width bank of drawers.

E. Cabinet bottom shall be formed of one piece of steel, except in corner units, and shall be formed down on sides and back to create a square edge transition welded to cabinet end panels. Front edge shall include a channel formation to form a 0.87-inch (22 mm) high bottom front rail and shall be flush with face of end uprights.

F. Toe space base recess shall extend up and forward to engage bottom panel to form a smooth surfaced, fully enclosed toe space, 3-inch deep by 4-inch high (76 mm deep by 102 mm high).

G. Cabinet back construction shall be fully-welded and welded at top and bottom of uprights.

H. Each bottom corner of base cabinets shall have a 0.37-inch (9.5 mm) leveling bolt, 2.6-inches (65 mm) long capable of supporting 500 lbs (227 Kg). Access to the leveling bolts shall be through plug buttons in the cabinet bottom. Adjusting cabinet level shall not require special tools.

I. Adjustable Shelves: Front and rear edges of shelves shall be formed into a channel shape. Ends of shelving shall be formed down, with edge even with front and rear channel face. Shelves over 3-feet, 6-inches (105 cm) long shall be further reinforced with a channel formation welded to underside of shelf.

   1. Shelving Adjustment Increments: Not more than 1-inch (25 mm).

J. Mechanical Service Area Knee Space Panels: Removable, 0.4-inch (1 mm) thick steel, finished to match metal casework cabinets.

1.12 UPPER CABINET CONSTRUCTION

A. Mounting Hardware: Design and fabricate upper cabinets so that no mounting hardware is visible when installed.

B. End uprights shall be formed at front, bottom and back to provide strength and rigidity. Front edge of end upright shall be 0.75-inch (19 mm) wide. A pilaster shall be added to the inside front of the upright for cabinet and hinge reinforcement and shall be perforated for hinge screws, and shelf adjustment holes.

C. Cabinet tops shall be formed with a 0.87-inch (22 mm) high channel formation at the front edge and turned down at the back to engage a wall hanging rail.

D. Upper Cabinet Bottoms:

1. Flush Bottoms: Formed with 0.87-inch (22 mm) high channel formation at front edge.
2. False Bottoms: Formed down on all four edges and shall be removable.

E. Upper Cabinet Backs: Welded to the top, bottom and ends. Backs shall be perforated for shelf adjustment holes. Holes shall be enclosed by end uprights.

1.13 FULL HEIGHT CABINET CONSTRUCTION

A. End uprights shall be formed at front, bottom and back to provide strength and rigidity. Front fascia of upright shall be 1.26-inch (32 mm) wide with inside edge formed in a channel 0.48-inch by 0.75-inch (12 mm x 19 mm).

B. Full height rectangular reinforcement shall be fitted to the channel and formed to provide a recessed strike for door and to reinforce the cabinet.

C. The backside of the reinforcement shall be perforated with shelf adjustment holes spaced at not more than 1-inch (25 mm) centers.

D. 0.06-inch (1.6 mm) hinge reinforcement shall be welded to inner side of front uprights.

1.14 DOOR CONSTRUCTION

A. Steel Doors:

1. Two-piece, solid panel swinging doors, consisting of an inner and outer door pan. Outer door pan shall be formed at all four sides. Inner door pan shall be flanged at all four sides with hinge reinforcements welded in place. The door assembly shall be 0.75-inch (19 mm) thick and contain sound deadening material. Door assemblies shall be painted prior to assembly, and shall be punched for attaching pulls. Inner pan formation of door shall be indented for in field installation of locks, when required.
2. Doors shall be readily-removeable with replaceable, screw-fastened hinges.

B. Glazed Steel Doors:

1. Two-piece, glazed door panel, construction similar to solid panel doors but with 2.3-inch (75 mm) formed metal frame with beveled edge around glass opening in center of door.
2. Glazing shall be held in place by rubber or vinyl gasket around entire perimeter of glazing.
3. Glazing shall be safety glazing as specified herein, of type as indicated on Drawings.

C. Sliding Doors

1. Suspend from the top in a roll formed steel track fastened to the cabinet top and shall glide on nylon rollers. Track shall be so designed to prevent accidental removal of doors

1.15 DRAWER CONSTRUCTION

A. Drawers:

1. Drawer bodies shall be made in one piece construction including the bottom, two sides, back and front. Drawer interior bottom shall be fully coved on all four sides for easy cleaning. The top front of the inner drawer body shall be offset to interlock with the channel formation in drawer head providing a 0.75-inch (19 mm) thick drawer head.

1.16 SPECIAL PURPOSE STORAGE CABINET CONSTRUCTION

A. Acid Storage Fume Hood Cabinets:

1. Cabinets: Acid storage fume hood cabinets shall utilize the same gauges of steel and construction features as other base cabinets except they shall be completely lined with a corrosion resistant liner.
2. Cabinet Doors: Each door shall have a set of louvers at the top and bottom, and have a corrosion resistant liner.

3. Venting Into Fume Hood: Where indicated, each cabinet shall be vented into the fume hood with a 1.5-inch (38 mm) vent pipe allowing a positive airflow directly into the fume hood exhaust system.

4. Liner Panel: When specified or shown on drawings, cabinet shall include a full-depth phenolic resin liner panel.

B. Solvent Storage Cabinets:

1. Solvent storage cabinets shall be specifically designed for the storage of flammable and combustible liquids. Construction shall comply with requirements of UFC, OSHA and NFPA No. 30.
2. Doors:

a. Bottoms, top, sides and doors shall be fabricated of 0.48-inch (12 mm) steel with double panel construction having a 1.5-inch (38 mm) air space between panels. All joints shall be welded, or screwed, to provide a rigid enclosure.
b. Doors shall swing on full-length stainless steel piano hinges and shall be fully insulated. The doors shall be self-closing and synchronized so that both doors will always fully close and latching will properly engage. The right hand door is equipped with a three point latching system that automatically engages when the doors close.
c. Equip each door with a fusible link hold open feature that ensures the door closes when the temperature outside the cabinet exceeds 165 degrees F.
d. Units 23.6-inches (600 mm) long have only one door, self-closing, and be equipped with a three point latching system and hold open feature.

3. Leak Pan and Adjustable Shelf: Provide 2-inches (50 mm) deep liquid tight pan cover at entire bottom of the cabinet to contain liquid leaks and spills. Provide a second pan to serve as a full depth adjustable shelf.
4. Cabinet Back: Provide two, 2-inches (50 mm) diameter, diametrically opposed vents with spark screens in the back of the cabinet as well as a grounding screw.
5. Finish: Matching finish at interior and exterior of solvent storage cabinets.
6. Cabinet Labeling: In accordance with referenced standards.

C. Vacuum Pump Cabinets

1. Vacuum pump cabinets shall utilize the same gauges of steel and construction features as other base cabinets except they shall be provided without a bottom to allow vacuum pumps and other equipment to be rolled in and out of the cabinet.
2. The interior of the cabinet shall be lined with a 1 inch thick neoprene foam for sound deadening and easy cleaning.
3. Each cabinet shall be furnished with a 220 VAC, 20 amp, duplex receptacle mounted on the inside cabinet back and a pilot lighted toggle switch mounted in the top front panel.
4. Each cabinet shall be furnished with a 1.5-inch (38 mm) diameter PVC vent pipe in the back for venting or access to the fume hood above.
5. The toe kick shall be attached to the doors and shall allow total access to the front of the cabinet.
6. [**Internal wiring from the switch and pilot light to receptacle shall not be furnished unless otherwise specified**] [**Provide internal wiring from switch and pilot light to receptacle**].

1.17 TABLE CONSTRUCTION

A. General: Freestanding tables shall consist of welded leg assemblies connected to aprons by mechanical fasteners.

B. Table apron rails shall be formed of 0.06-inch (1.6 mm) steel. The rails shall be 7.87-inches (200 mm) high, formed top and bottom into a channel formation. Where drawers occur, the apron rails shall provide the required opening for drawer size(s) indicated.

C. Table legs shall be 2-inch (50 mm) square welded tubing. Securely welded to bottom end shall be a 0.08-inch (2.0 mm) die formed gusset with four flanges. A threaded clinch nut shall accommodate a 0.37-inch by 2.56-inches (9.5 mm by 65 mm) long leveling bolt. Leg shoes shall be provided on all table legs, unless otherwise specified, to conceal leveling bolts.

D. Stretchers shall be constructed of 0.05-inch (1.2 mm) steel and furnished where indicated on drawings. They shall be formed into a 2.17-inches by 1.5-inch (55 mm by 38 mm) channel formation, and secured to table legs by a die formed clip of 0.06-inch (1.6 mm) steel. Clips shall be welded at ends of channel.

1.18 HARDWARE, METAL CASEWORK

A. Handles (Pulls): ADA-compliant.

1. Door and Drawer Handles (Pulls): Manufacturer's "hooded" pull.
2. Sliding Door Handles (Pulls): Manufacturer's standard recessed pull.

B. Hinges:

1. Overlay Concealed 170° Swing
2. Fully concealed hinges with a matte nickel finish. Hinge shall have three dimensional adjustment and provide up to 170° opening. It shall incorporate an integrated catch to keep the door closed without the use of additional catch hardware. Doors under 3-feet (92 cm) in height shall be hung on one pair of hinges, and doors over 3-feet (92 cm) in height shall be hung on three hinges.

C. Drawer Slide:

1. Heavy duty, full extension, soft-close, self-closing, zinc plated, ball bearing slides, rated for 99 lbs. (45 Kg) loads.

D. Locks: Cam type[**with five-pin tumbler**], [**interchangeable core,**] brass with nickel finish. [**Provide in locations, as indicated**]. Keying as determined per Keying Conference.

1. Provide minimum of two keys per lock and two master keys.
2. Master Key System: All locks operable by master key.

E. Shelf Adjustment Clips: Die-formed, nickel-plated steel.

F. Casters: Heavy-duty, swiveling-type, locking and non-locking, as indicated. Load capacity 154.32 lbs. (70 kg), each caster, unless otherwise indicated.

G. Leg Shoes: Leg shoes shall be a pliable, white HDPE material and shall be provided on all table legs, unless otherwise specified, to conceal leveling device.

H. Base Molding: Provided by [**Section 096513 - Resilient Base and Accessories**] <**insert section**>.

I. Sink Supports:

1. Hanger type, suspended from end panels of sink cabinet by four 0.24-inch (6 mm) dia. rods, threaded at bottom end and offset at top to hang from two full-depth reinforcements, welded to the top of end panels.
2. Two 7.5-inches by 1.5-inch by 0.12-inch (19 mm by 38 mm by 3 mm) channels shall be hung on the threaded rods to provide an adjustable sink cradle for supporting sinks.

J. Support Struts:

1. Two each 0.08-inch (2 mm) channel uprights fastened top and bottom by two adjustable 0.12-inch (3 mm) channel spreaders, each, 1.5-inch (38 mm) by length required, formed from galvanized steel. Struts shall be furnished to support drain troughs, and to support worktop at plumbing space under fume hood superstructures or other heavy loads.
2. Provide optional support struts to support mechanical service piping and drain lines.

1.19 SINKS[**AND DRIP CUPS (TROUGHS)**]

A. Stoneware Sinks In Stoneware Worktops:

1. Sizes: Provide in the following sizes, as indicted on Drawings.

a. 15.75 inches (400 mm) by 15.75 inches (400 mm) by 9.84 inches (250 mm).
b. 19.75 inches (500 mm) by 15.75 inches (400 mm) by 9.84 inches (250 mm).

2. Mounting: Factory-fitted, flush.

B. Polypropylene Sinks In [**Melamine Resin,**][**Solid Grade Laminate,**][**Phenolic Resin (Trespa Toplab+)**][**Glass**] Worktops:

1. Sizes: Provide in the following sizes, as indicted on Drawings.

a. 12.6 inches (320 mm) by 12.6 inches (320 mm) by 7.87 inches (200 mm).
b. 15.75 inches (400 mm) by 15.75 inches (400 mm) by 9.84 inches (250 mm).

c. 19.75 inches (500 mm) by 15.75 inches (400 mm) by 9.84 inches, nom. (250 mm).

2. Mounting: Sink with raised edge inserted into the worktop from above.

C. Stainless Steel Sinks In [**Melamine Resin Coating**][**Solid Grade Laminate**][**Phenolic Resin (Trespa Toplab+)**][**Glass**] worktops:

1. Sizes: Provide in the following sizes, as indicted on Drawings.

a. 13.39 inches (340 mm) by 14.57 inches (370 mm) by 5.91 inches (150 mm).
b. 19.75 inches (500 mm) by 15.75 inches (400 mm) by 9.84 inches (250 mm).

2. Mounting: Sink with raised edge inserted into worktop from above.

D. Polypropylene Sinks In Polypropylene Worktops:

1. Sizes: Provide in the following sizes, as indicted on Drawings.

a. 15.16 inches (385 mm) by 15.16 inches (385 mm) by 9.84 inches (250 mm).
b. 19.09 inches (485 mm) by 15.16 inches (385 mm) by 9.84 inches (250 mm).

2. Mounting: Sink attached to worktop from below and welded.

E. Stainless Steel Sinks in Stainless Steel Worktops:

1. Sizes: Provide in the following sizes, as indicted on Drawings.

a. 15.75 inches (400 mm) by 15.75 inches (400 mm) by 9.84 inches (250 mm).
b. 19.75 inches(500 mm) by 15.75 inches (400 mm) by 9.84 inches (250 mm).

2. Mounting: Factory-fitted, flush.

F. Stoneware Sinks In Stoneware Epoxy (Compound) Worktops:

1. Sizes: Provide in the following sizes, as indicted on Drawings.

a. 14.96 inches (380 mm) by 14.96 inches (380 mm) by 9.84 inches (250 mm).
b. 19.75 inches (500 mm) by 14.96 inches (380 mm) by 9.84 inches (250 mm).

2. Mounting: Factory-fitted, flush.

G. Epoxy Sinks:

1. Sizes: Provide in the following sizes, as indicted on Drawings.

a. 15.98 inches (406 mm) by 12.01 inches (305 mm) by 7.99 inches (203 mm).
b. 15.98 inches (406 mm) by 15.98 inches (406 mm) by 7.48 inches (190 mm).
c. 18.75 inches (475 mm) by 14.96 inches (380 mm) by 10.98 inches (279 mm).

2. Mounting: Factory-fitted, flush.

H. Stoneware Sinks Installed in Sink Module:

1. Sink Module: Self-supporting, integrally molded stoneware draining area with marine edging.

2. Sizes: [**As indicated on Drawings.**]

    a. Width(s): [**23.62 inches (600 mm)**][**47.24 inches (1200)**][**59.06 (1500)**][**70.87 (1800)**].
    b. Depth(s):

        1) Sink Module for Wall Bench With Service Spine: [**26.57 inches (675 mm)**][**32.48 inches (825 mm)**].
        2) Sink Module for Double Bench With Service Spine: [**27.76 inches (760 mm)**][**33.66 inches (855 mm)**].
        3) Sink Module for in Front of Building Wall: [**29.92 inches (760 mm)**][**35.83 inches (910 mm)**].
        4) Sink Module as End Sink: 28.74 inches (730 mm). (Note: for 59.06 inch and 70.87 inch widths only.)

3. Overall Height, Sink Module With Under-Bench Unit: Front, 35.83 inches (910 mm) to 37.40 inches (950 mm), rear.
4. Height of Sink Edging: Front, 0.79 inch (20 mm) to 1.97 inches (50 mm) at rear of unit.
5. Configurations: Provide in configurations and with under-bench base cabinet units as indicated on Drawings.
6. Mounting: Factory-fitted, flush.
7. Plumbing:

    a. Water Connection: Fixed.
    b. Waste Water Connection: Fixed with siphon.
    c. [**Water Fitting: Optional bench-mounted fitting.**]
    d. [**Optional Eye Wash.**]

1.20 ACCESSORIES

A. Pegboard: For mounting above sinks on service module uprights or for wall mounting.

1. Dimensions (W,H): 23.63 inches (600 mm) by 14.17 inches (360 mm).

    a. Drainage Peg Diameter: [**0.47 inch (12 mm)**][**0.36 inch (9 mm)**].

2. Construction: Cover panel with pegboard, 18 drainage pegs and 2 removable drainage basins.
3. Electrical:

    a. Electrical Supply: Maximum 4 each power outlets with alternating current in service panels.
    b. Maximum 230 V Outlets Per Panel: 4 each.

4. Plumbing:

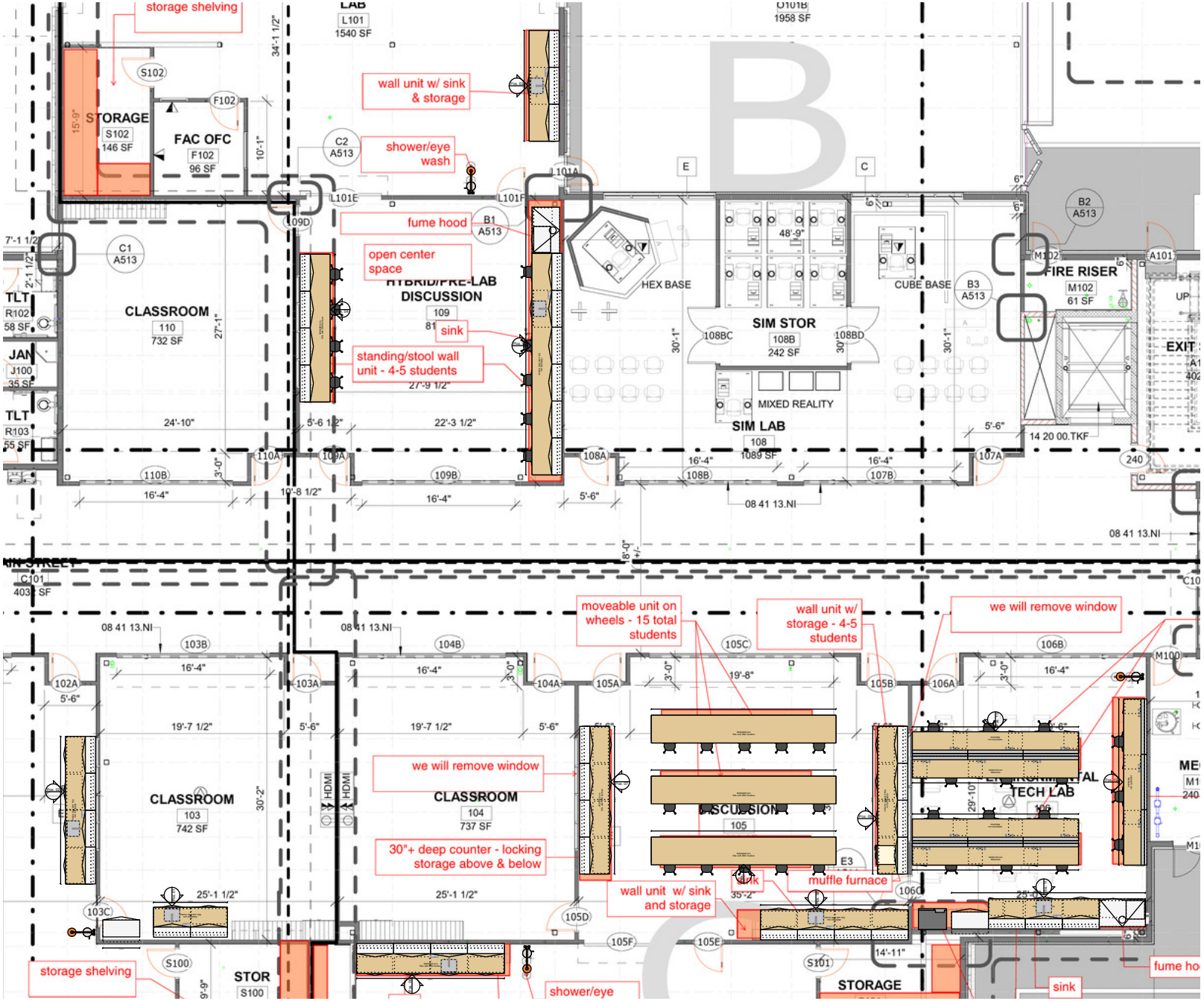
    a. Supply: Fittings for vacuum, gases or compressed air, as indicated.
    b. Maximum Number of Valves per Panel: 2 each.
    c. Maximum Number of High Purity Gas Valves per Panel: Verify with manufacturer.

B. Under-Bench Exhaust: Exhaust extraction from under-bench safety cabinets in service spines and fume hoods. [**Coordinate with Section 115313 - Laboratory Fume Hoods.**]

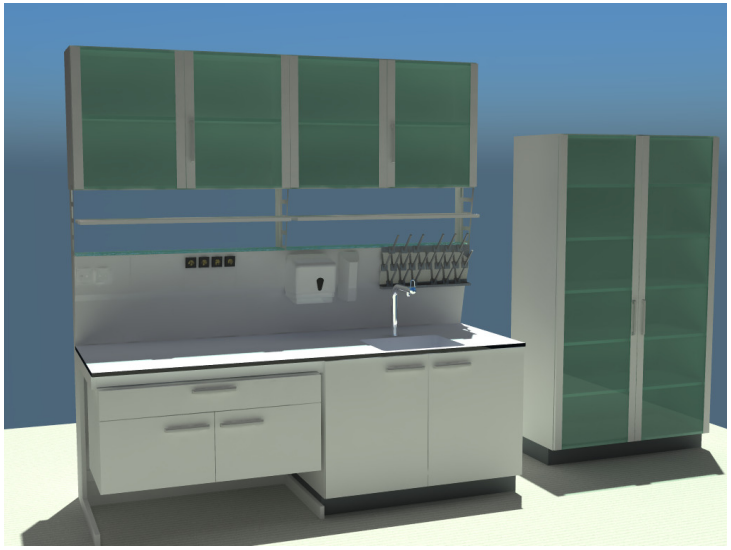
1. Ventilation Pipe Material: Polyphenylene sulfide (PPS).

2. Volume Flow: 23.5 cfm (40 m^3/h).
3. Ventilation Pipe Connector (ascending duct) Diameter: 3.54 inches (90 mm).
4. Provide ventilation slots at plinth (base), as required.

SENMC Elevations & Position Descriptions



TYPE: A



Position Description: Elevation_01

Wall Bench-01
Length: 2400mm
Depth: 900mm
Working Height: 900mm

2x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

1x 1200mm wide suspended UB with C-frame

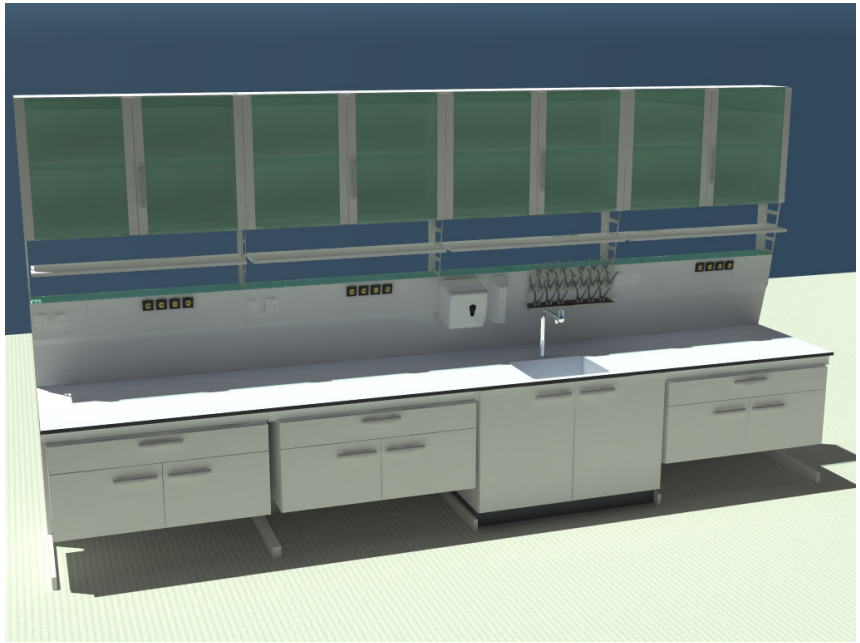
2x 1200mm wide spine mounted overhead cabinets with glass doors

1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser & 2 peg boards, deep sink in PP

Services: 4x 125V Duplex GFCIreceptacles , 2x Data sockets.

Tall Cabinet: 1x 1200mm wide Tall storage cabinet with glass doors and internal shelves height adjustable

TYPE: B



Position Description: Elevation_02

Wall Bench-02
Length: 4800mm
Depth: 900mm
Working Height: 900mm

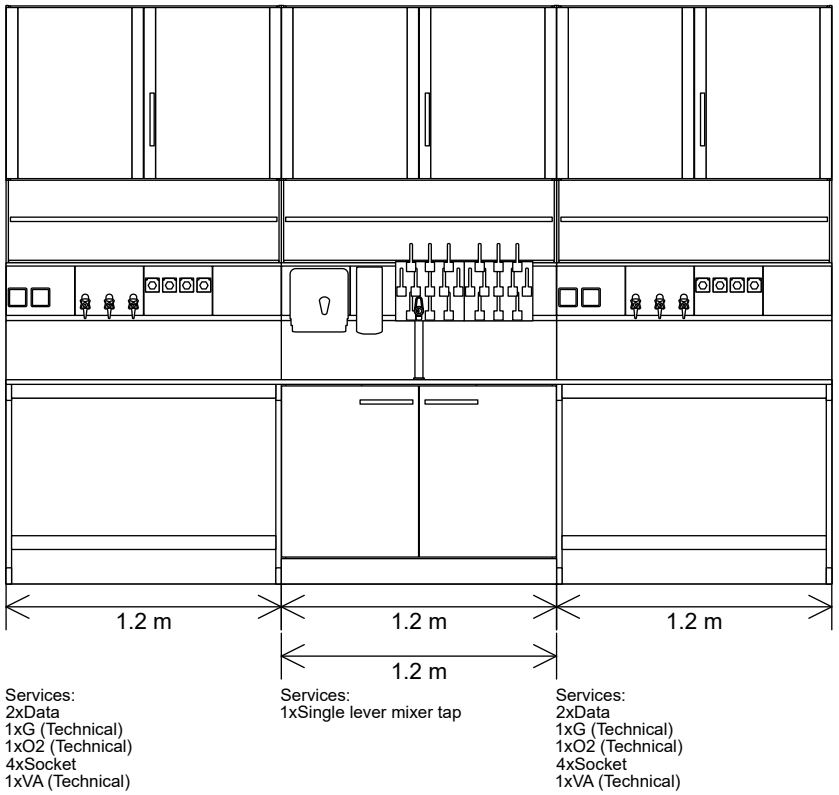
4x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

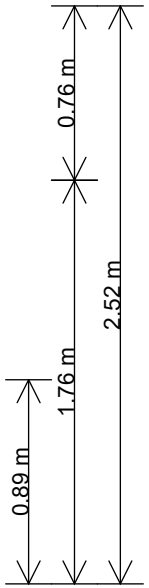
3x 1200mm wide suspended UB with C-frame

4x 1200mm wide spine mounted overhead cabinets with glass doors

1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser & 2 peg boards & deep sink in PP

Services: 12x 125V Duplex GFCI receptacles , 6x Data sockets.





Position Description: Elevation_03

TYPE: C

Wall Bench-03
Length: 3600mm
Depth: 900mm
Working Height: 900mm

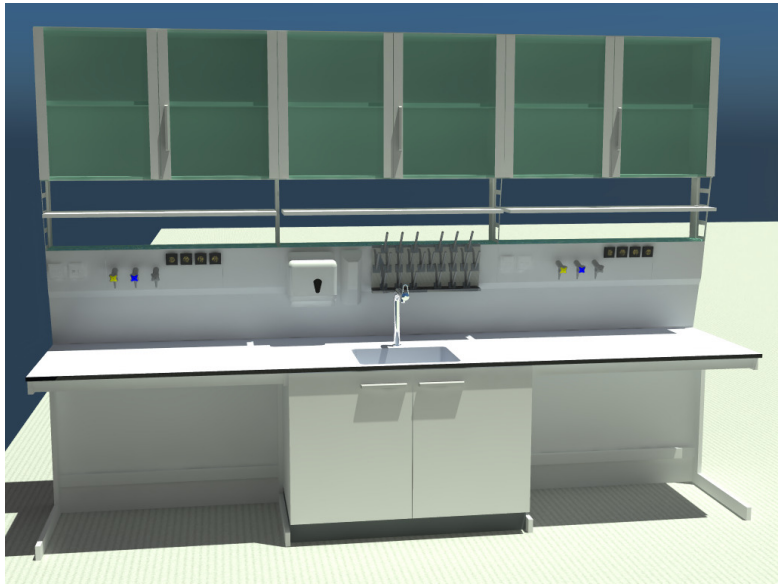
3x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

2x 1200mm wide C-frame

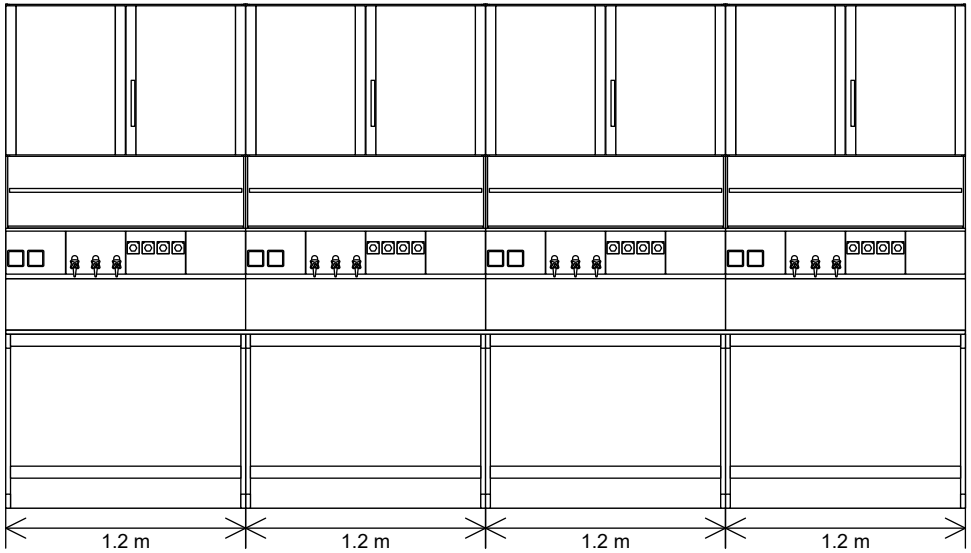
3x 1200mm wide spine mounted overhead cabinets with glass doors

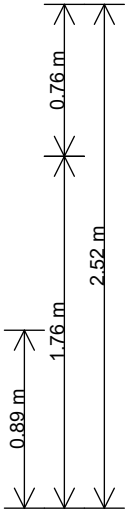
1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser & 2 peg boards & deep sink in PP

Services: 8x 125V Duplex GFCI receptacles , 4x Data sockets.



Position Description: Elevation_04





Wall Bench-04
Length: 4800mm
Depth: 900mm
Working Height: 900mm

4x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

4x 1200mm wide C-frame

4x 1200mm wide spine mounted overhead cabinets with glass doors

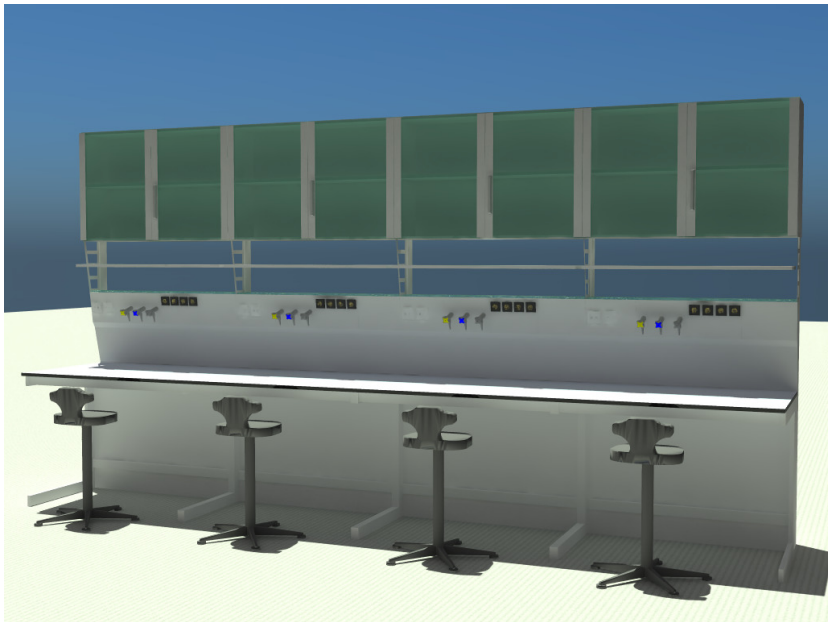
Services: 16x 125V Duplex GFCI receptacles , 8x Data sockets.
4x Lab Gas, 4x Oxygen, 4x Vacuum

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

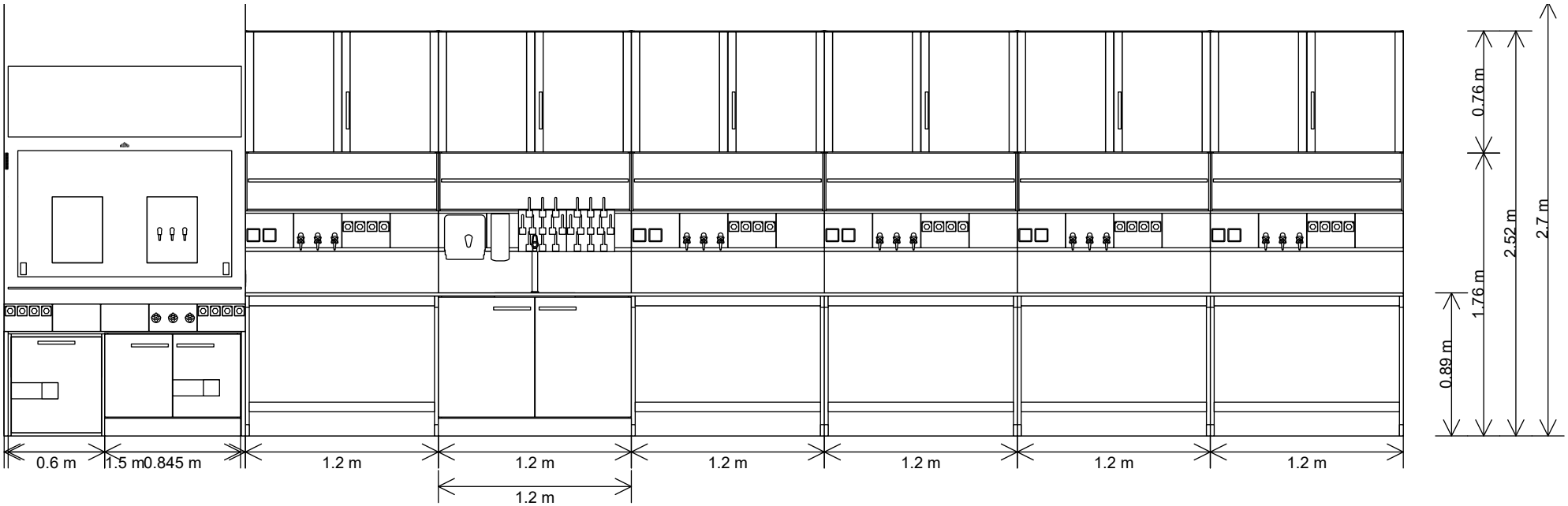
Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)



TYPE: D



FAZ

Services:
1xG (Technical)
1xO2 (Technical)
8xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
1xSingle lever mixer tap

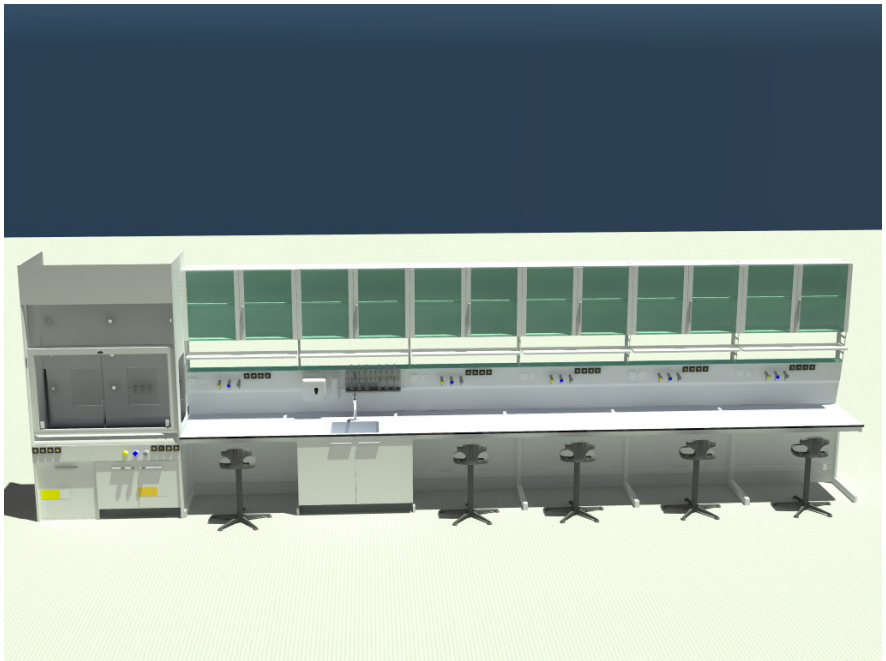
Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

TYPE: E



Position Description: Elevation_05

Wall Bench-05
Length: 7200mm
Depth: 900mm
Working Height: 900mm

6x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

5x 1200mm wide C-frame

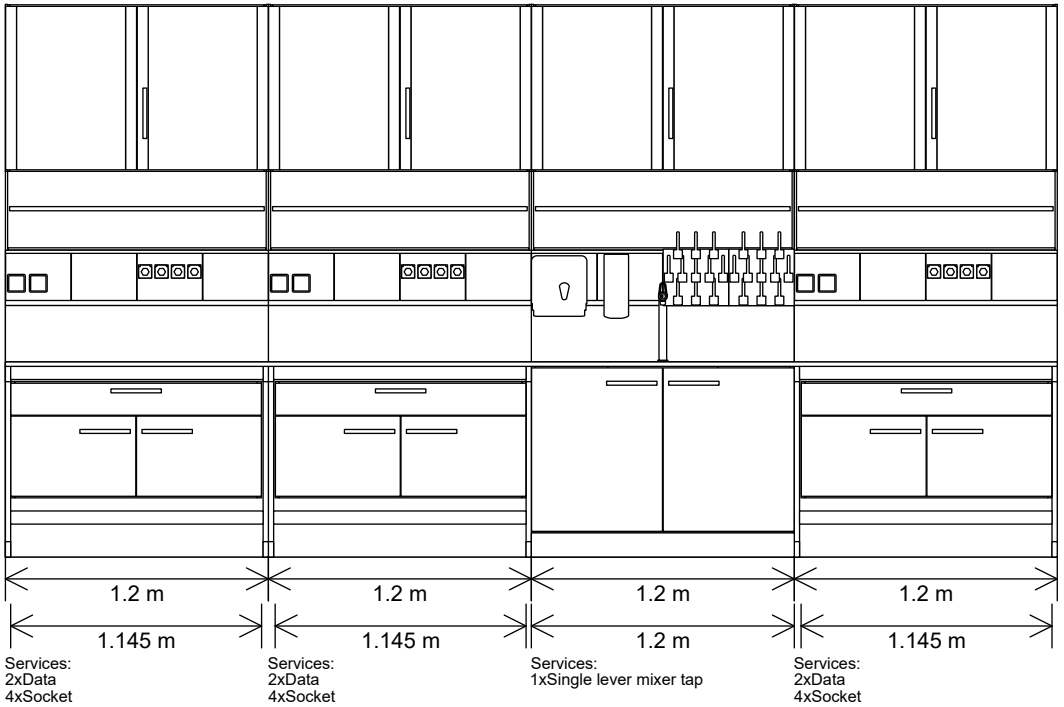
6x 1200mm wide spine mounted overhead cabinets with glass doors

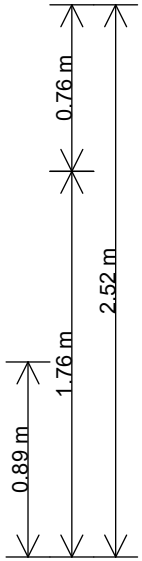
1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser
& 2 peg boards & deep sink in PP

Services: 20x 125V Duplex GFCI receptacles , 10x Data sockets.
5x Lab Gas, 5x Oxygen, 5x Vacuum

Fume Hood_01:
Length: 1500mm
Depth: 900mm
Working Height: 900mm
Total Height: 2700mm

Worktop: Industrial Ceramic/Stoneware
Airflow Monitor: FAZ; Cable port: Right side, Glass view panel: Ride side wall
Inner liner: SGL
UB: 1x Solvent, 1x Acid Storage Cabinet
Services: 8x 125V Duplex GFCI,
1x Lab Gas, 1x Oxygen, 1x Vacuum





Position Description: Elevation_06

Wall Bench-06
Length: 4800mm
Depth: 900mm
Working Height: 900mm

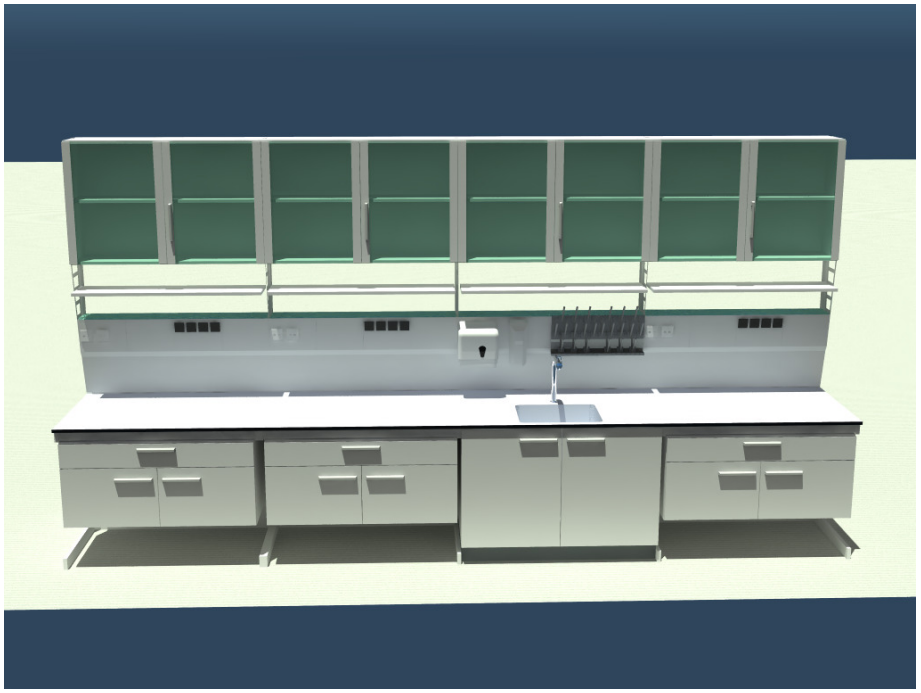
4x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

3x 1200mm wide C-frame with 1200mm wide susppended UB's

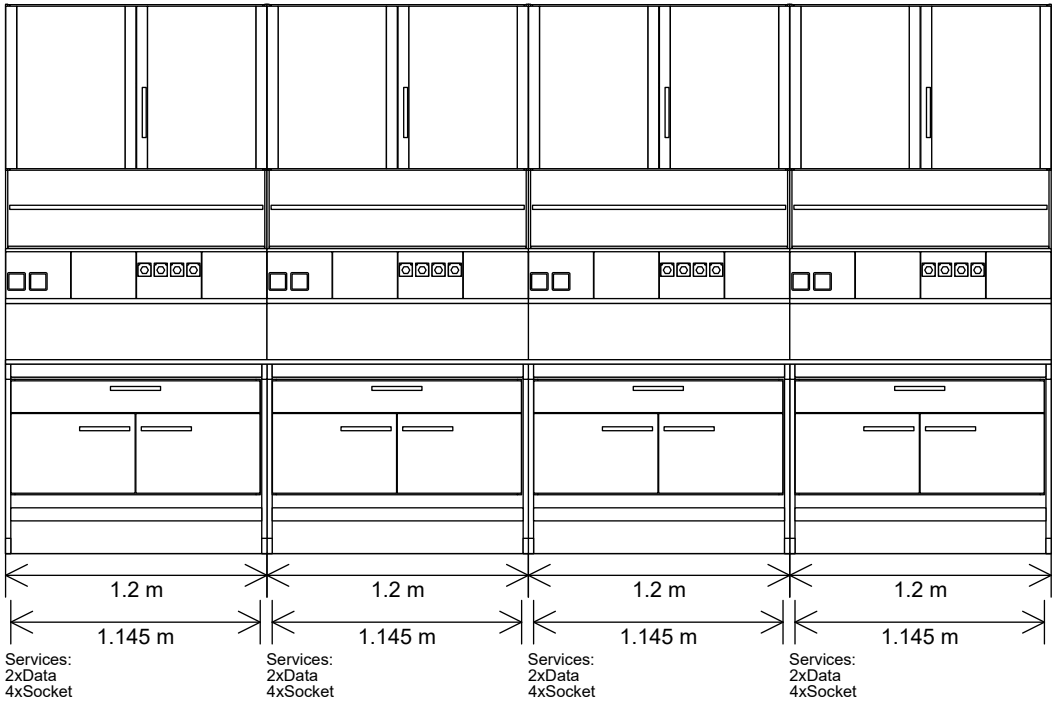
4x 1200mm wide spine mounted overhead cabinets with glass doors

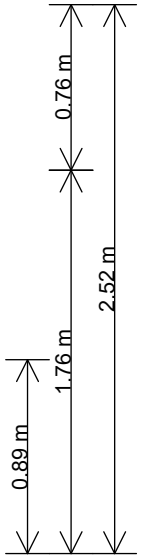
1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser & 2 peg boards & deep sink in PP

Services: 12x 125V Duplex GFCI receptacles ,



TYPE: F





Position Description: Elevation_07

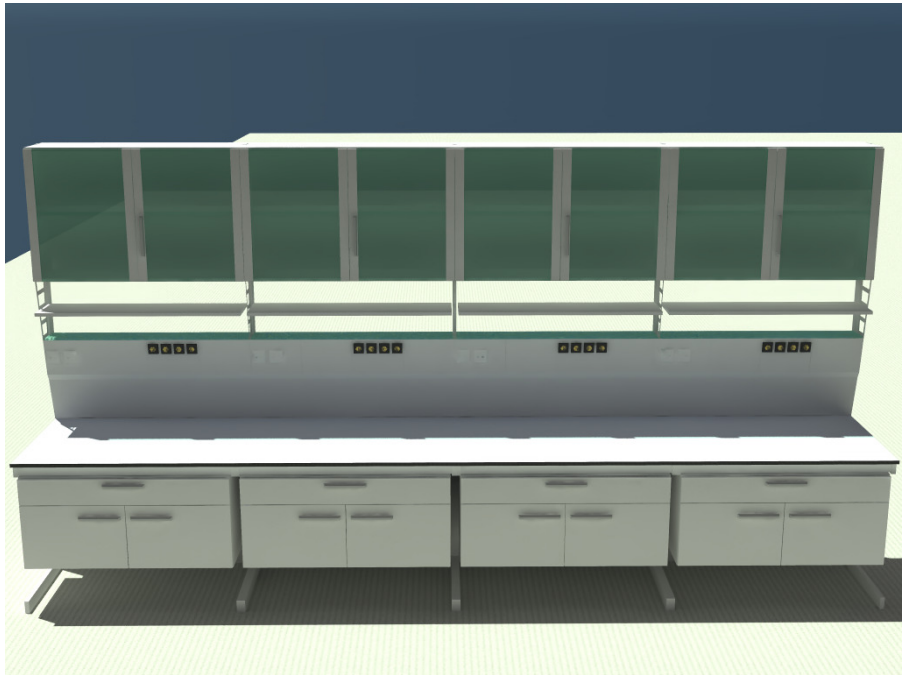
Wall Bench-07
Length: 4800mm
Depth: 900mm
Working Height: 900mm

4x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

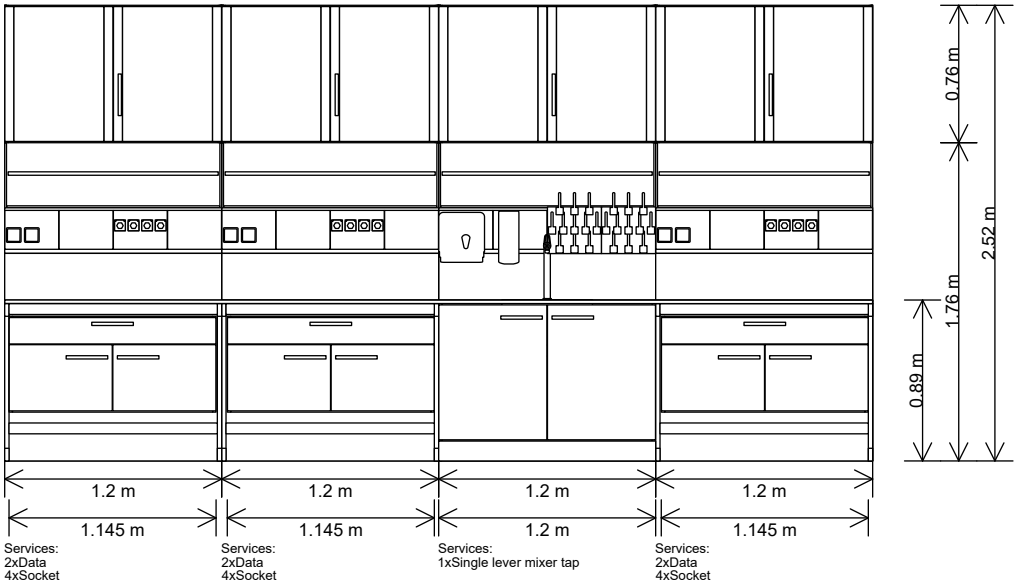
4x 1200mm wide C-frame with 4x1200mm wide suspended UB's

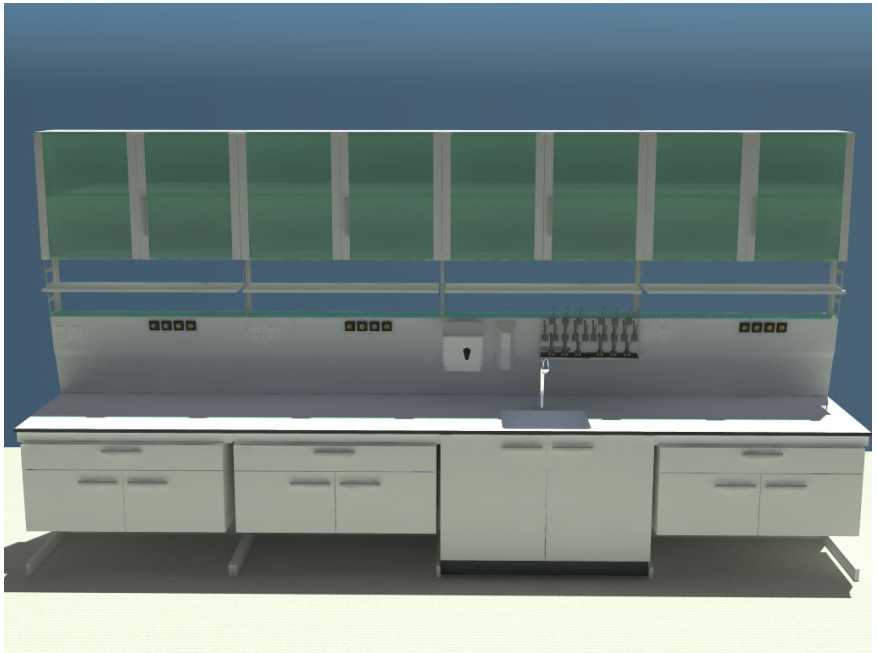
4x 1200mm wide spine mounted overhead cabinets with glass doors

Services: 16x 125V Duplex GFCI receptacles , 8x Data sockets.



TYPE: G





Position Description: Elevation_08

Wall Bench-08
Length: 4800mm
Depth: 900mm
Working Height: 900mm

4x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

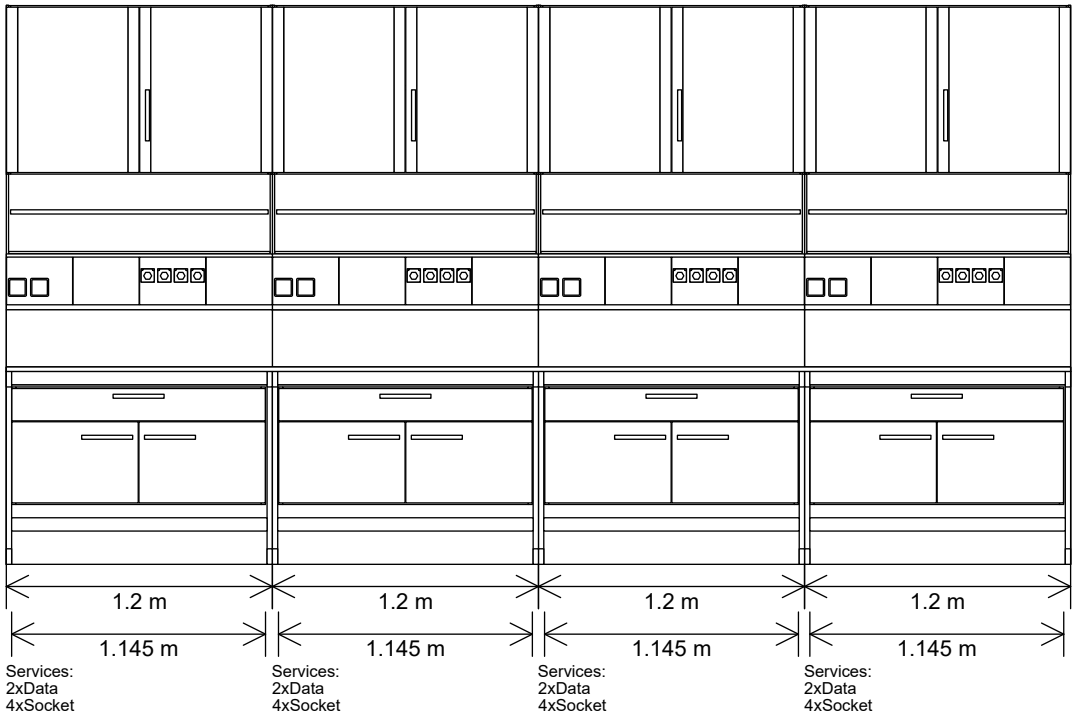
3x 1200mm wide C-frame with 3x1200mm wide Suspended UB's

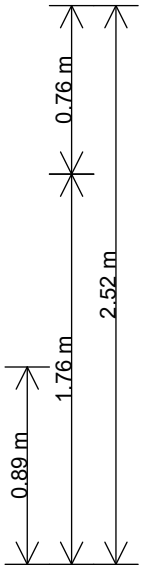
4x 1200mm wide spine mounted overhead cabinets with glass doors

1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser & 2 peg boards & deep sink in PP

Services: 12x 125V Duplex GFCI receptacles , 6x Data sockets.

TYPE: H





Position Description: Elevation_09

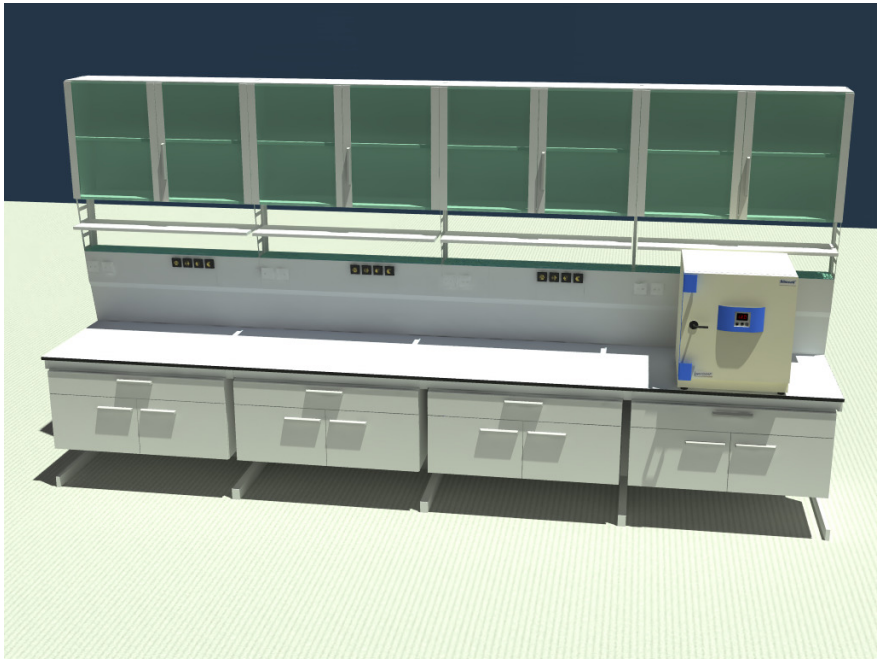
Wall Bench-09
Length: 4800mm
Depth: 900mm
Working Height: 900mm

4x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

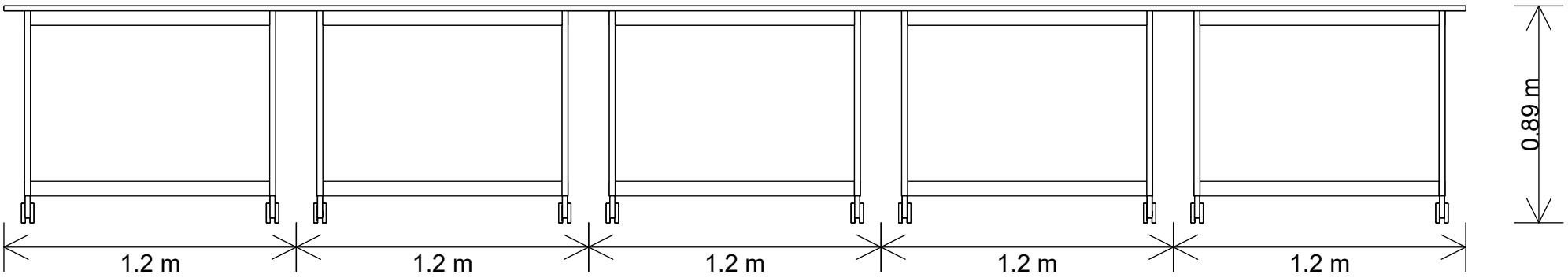
4x 1200mm wide C-frame with 4x1200mm wide Suspended UB's

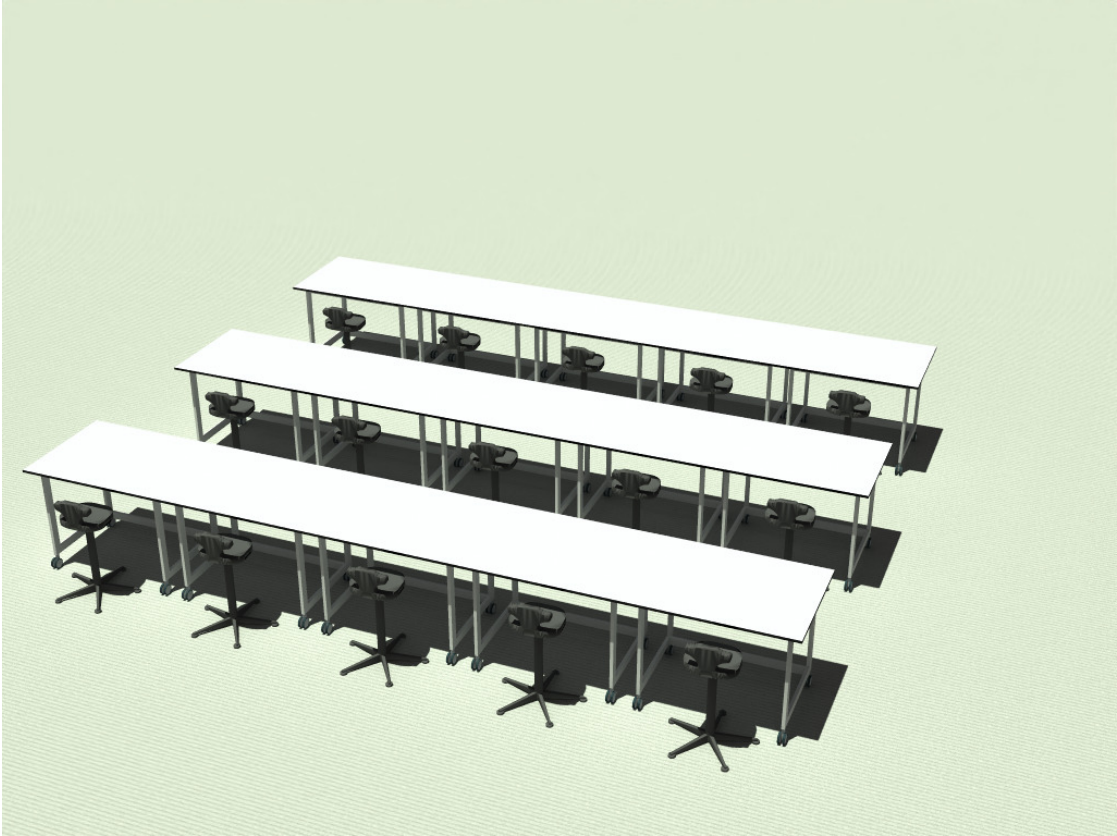
4x 1200mm wide spine mounted overhead cabinets with glass doors

Services: 16x 125V Duplex GFCI receptacles , 8x Data sockets.



TYPE: I



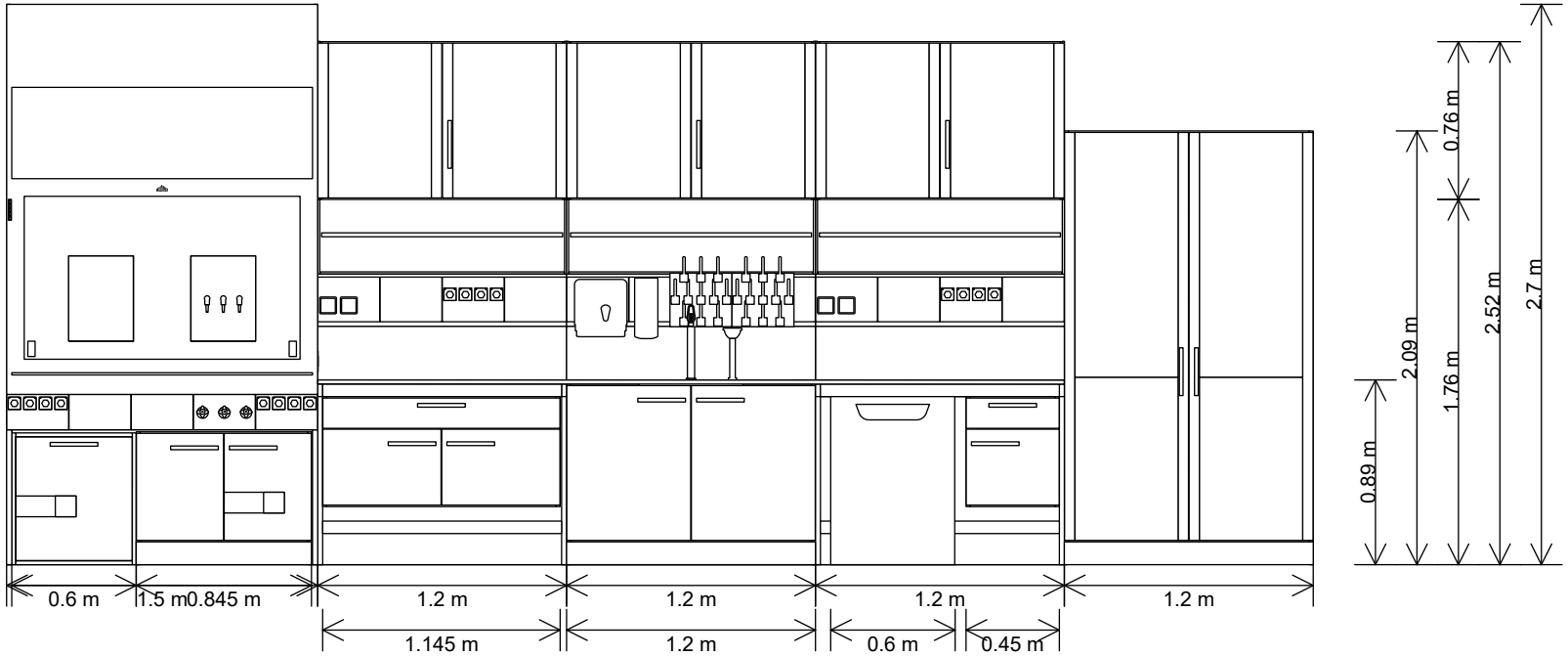


Position Description: Elevation_10

Island Bench-1 (Qty03)
Length: 6000mm
Depth: 900mm
Working Height: 900mm

5x 1200mm wide mobile carts with TRESPA WT.
Heavy duty carts with lockable wheels.

TYPE: J



FAZ

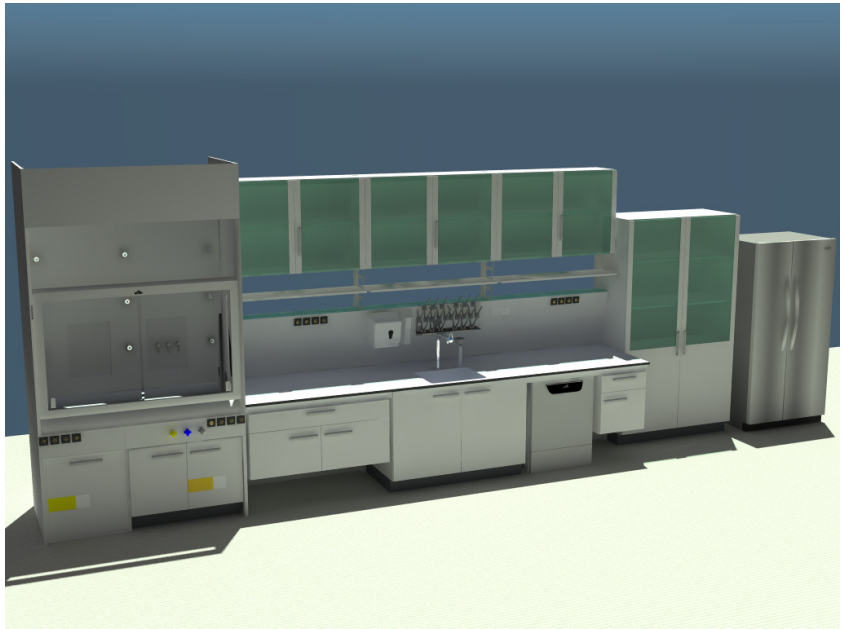
Services:
1xG (Technical)
1xO2 (Technical)
8xSocket
1xVA (Technical)

Services:
2xData
4xSocket

Services:
1xEye shower
1xSingle lever mixer tap

Services:
2xData
4xSocket

TYPE: K



Position Description: Elevation_11

Wall Bench-10
Length: 3600mm
Depth: 900mm
Working Height: 900mm

3x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,

2x 1200mm wide C-frame
Suspended UB's for C-frames: 1x 1200mm, 1x 450mm wide

3x 1200mm wide spine mounted overhead cabinets with glass doors

1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser
& 2 peg boards & deep sink in PP

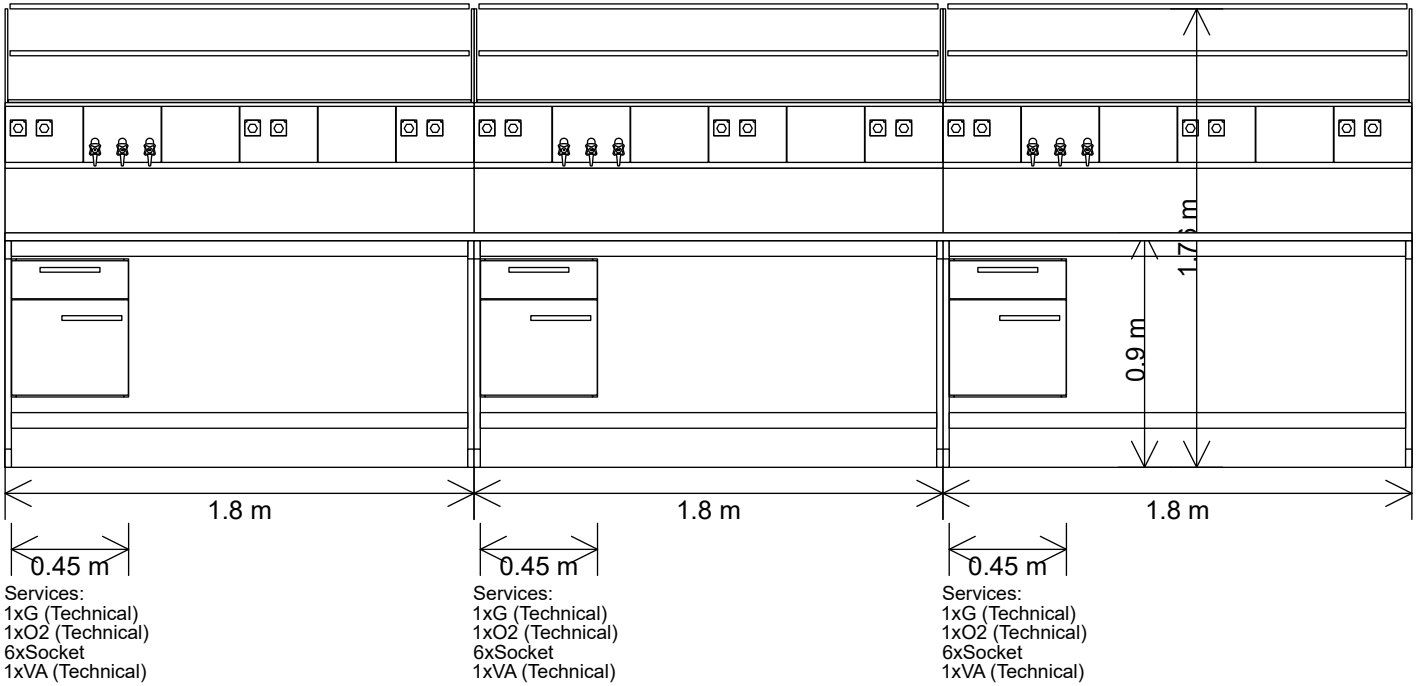
Services: 8x 125V Duplex GFCI receptacles , 4x Data sockets.

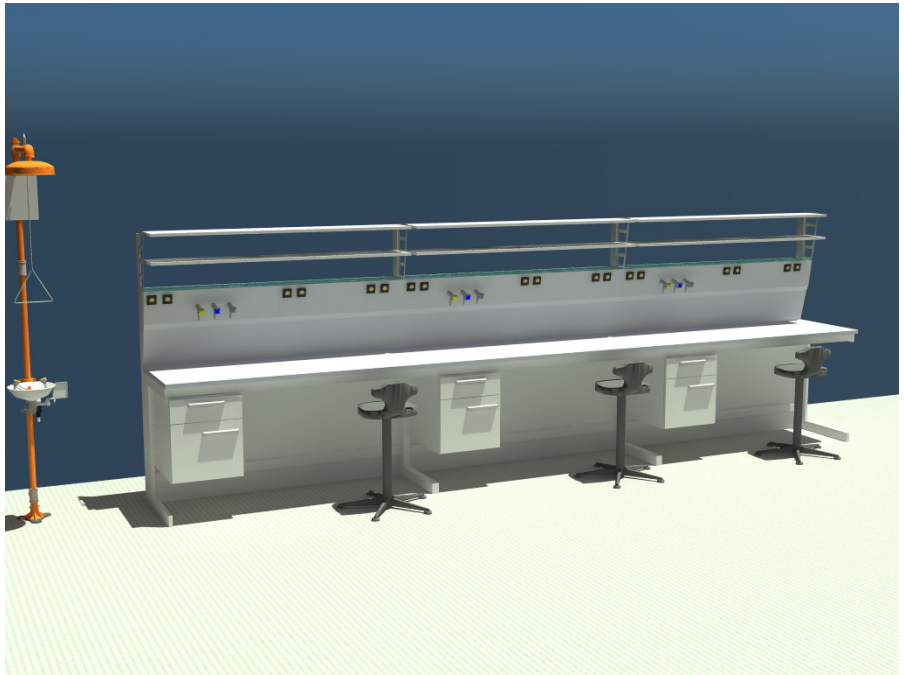
Tall Cabinet: 1x 1200mm wide with glass doors and height adjustable shelves.

Fume Hood_02:
Length: 1500mm
Depth: 900mm
Working Height: 900mm
Total Height: 2700mm

Worktop: Industrial Ceramic/Stoneware
Airflow Monitor: FAZ; Cable port: Right side, Glass view panel: Ride side wall
Inner liner: SGL
UB: 1x Solvent, 1x Acid Storage Cabinet
Services: 8x 125V Duplex GFCI,
1x Lab Gas, 1x Oxygen, 1x Vacuum

TYPE: L





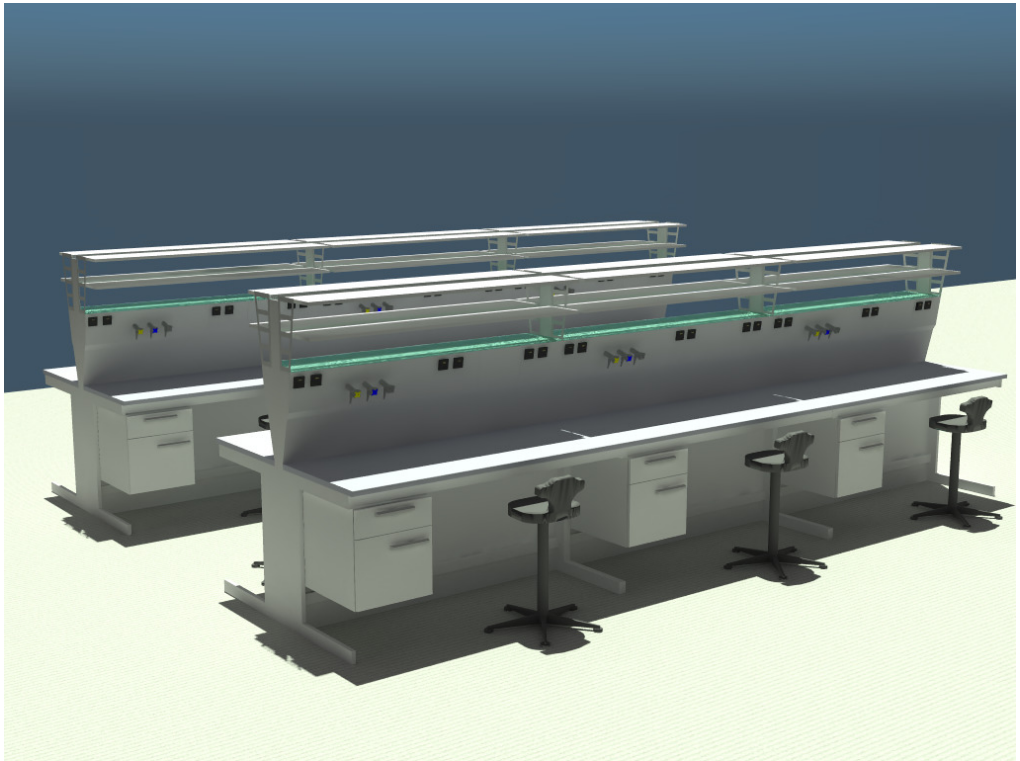
Position Description: Elevation_12

Wall Bench-11
Length: 5400mm
Depth: 900mm
Working Height: 900mm

3x 1800mm wide Single Sided service spine with shelving, Complete TRESPA WT,
3x 1800mm wide C-frame with 3x450mm wide Suspended UB's

Services: 18x 125V Duplex GFCI receptacles , 9x Data sockets.
3x Lab Gas, 3x Oxygen, 3x Vacuum.

TYPE: M



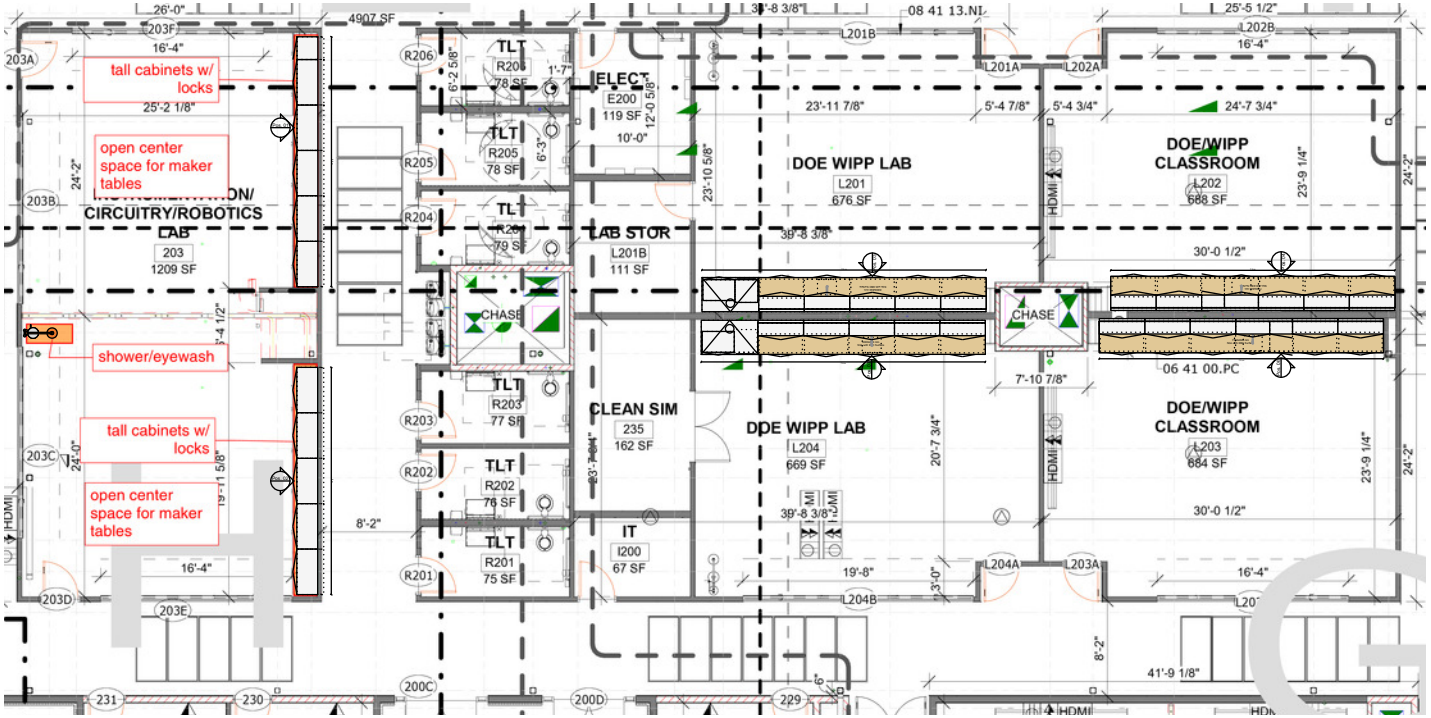
Position Description: Elevation_13

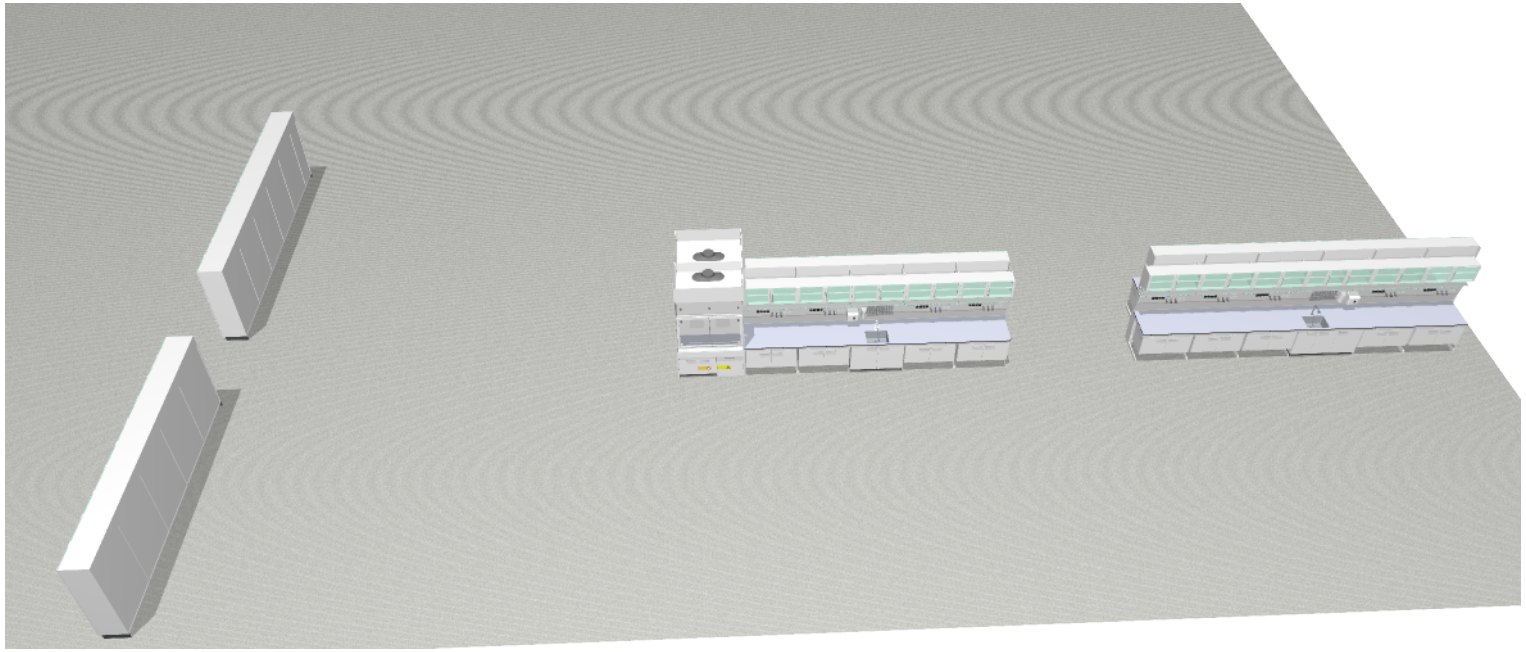
Island Bench-02 (Qty:02)
Length: 5400mm
Depth: 1800mm
Working Height: 900mm

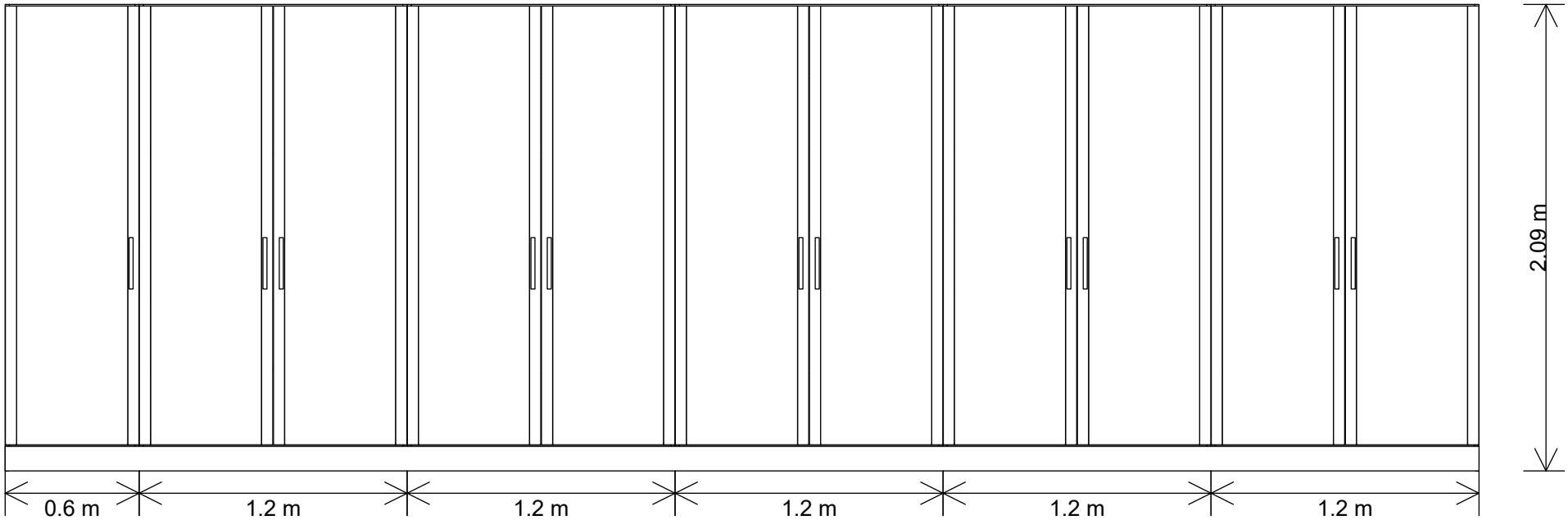
3x 1800mm wide Double Sided service spine with shelving, Complete TRESPA WT,
6x 1800mm wide C-frame with 6x450mm wide Suspended UB's

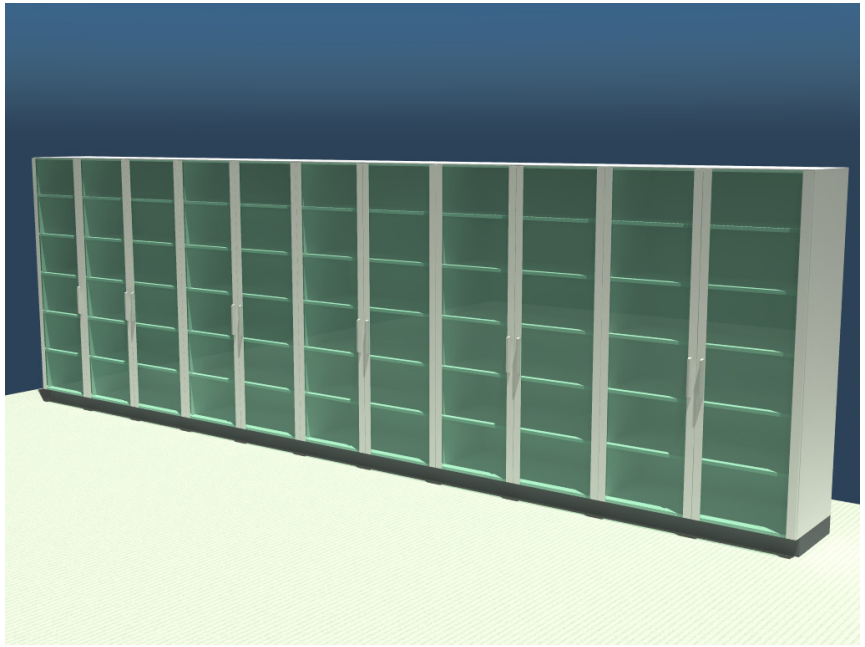
Services: 36x 125V Duplex GFCI receptacles , 9x Data sockets.
6x Lab Gas, 6x Oxygen, 6x Vacuum.

SENMC 102: Elevations







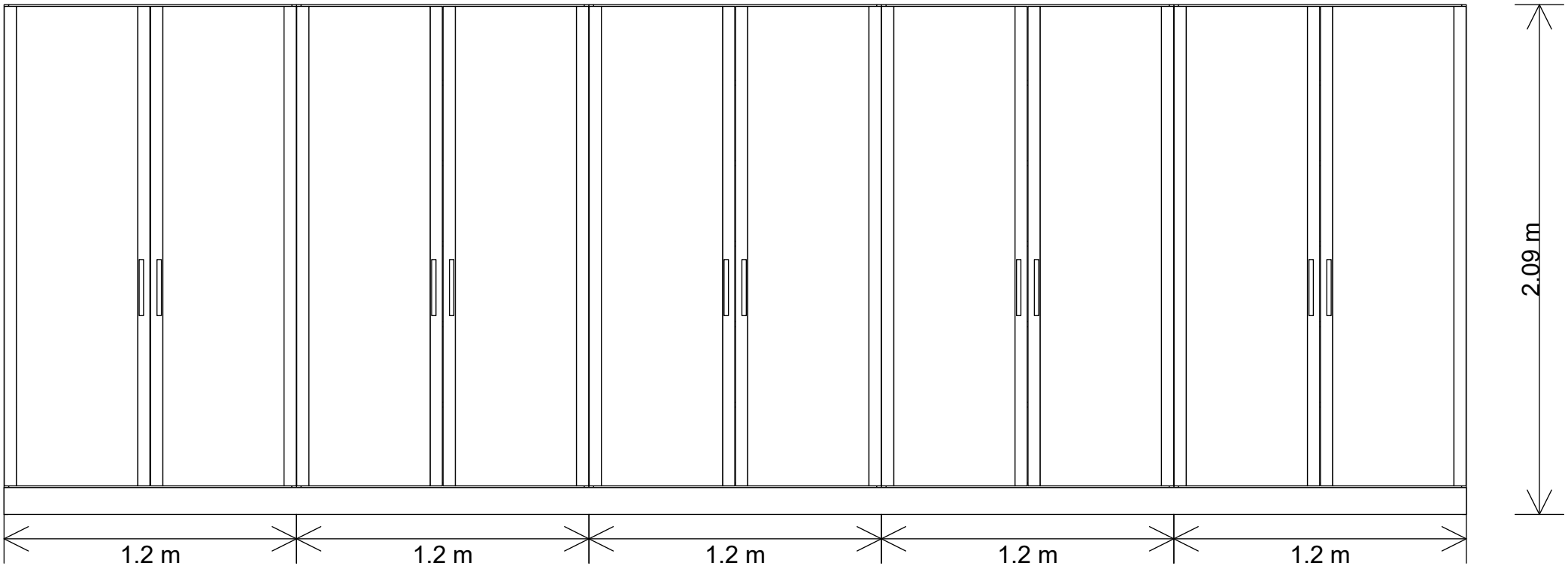


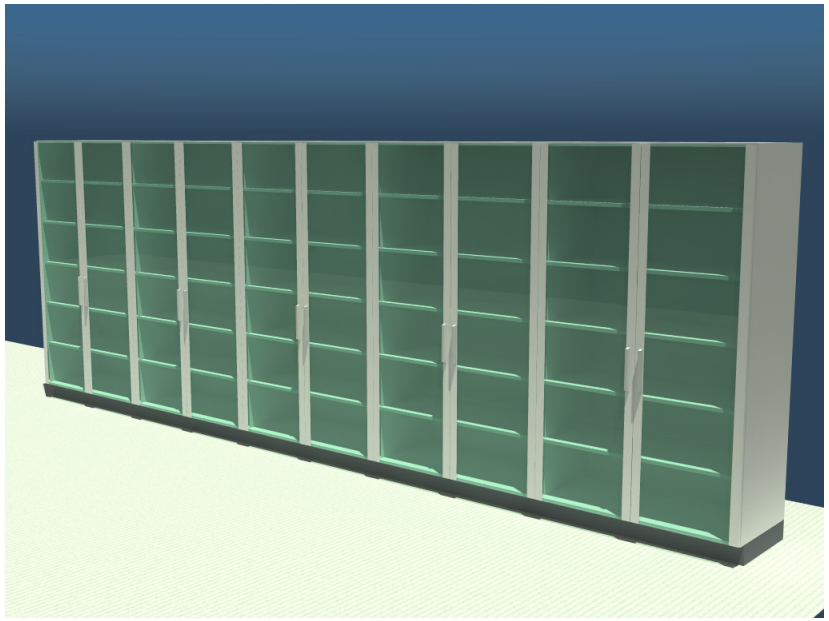
Position Description: 102_Elevation_01

TYPE: N

Tall Cabinets:

5x1200mm wide
1x600mm wide
Glass door with height adjustable shelves



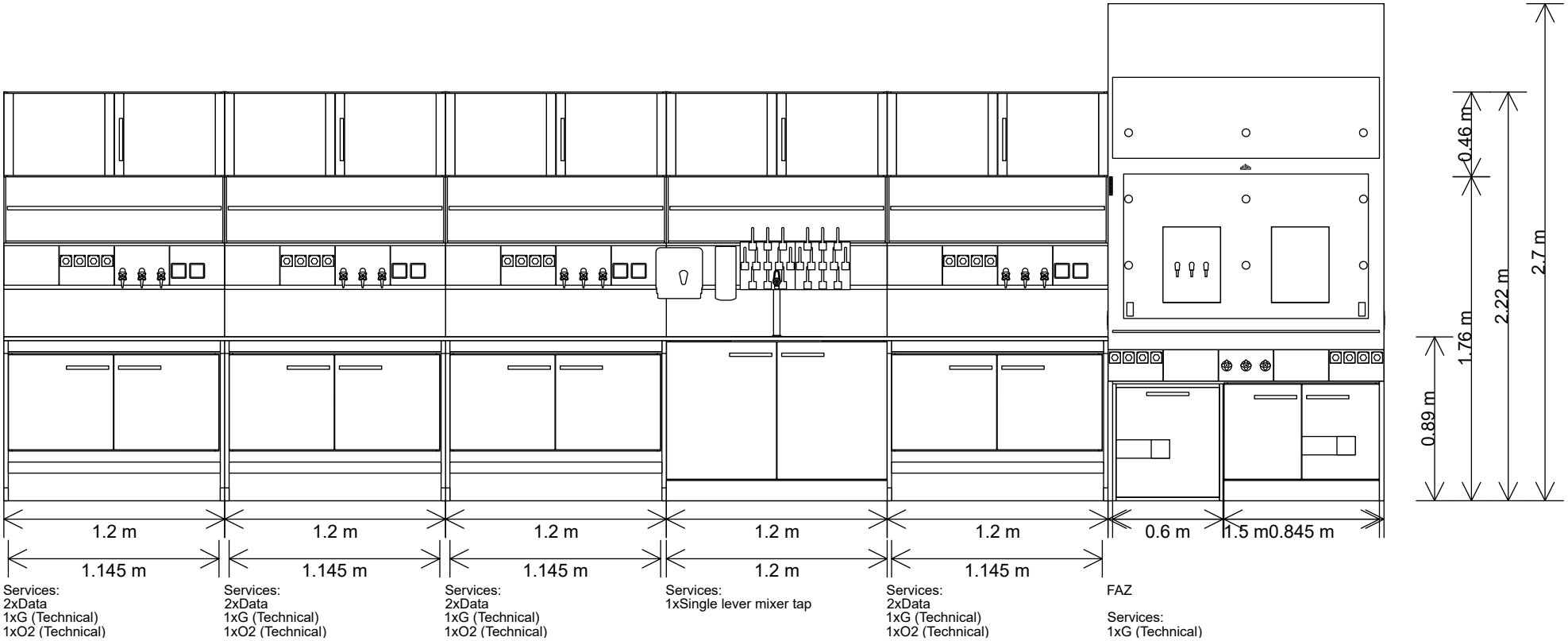


Position Description: 102_Elevation_02

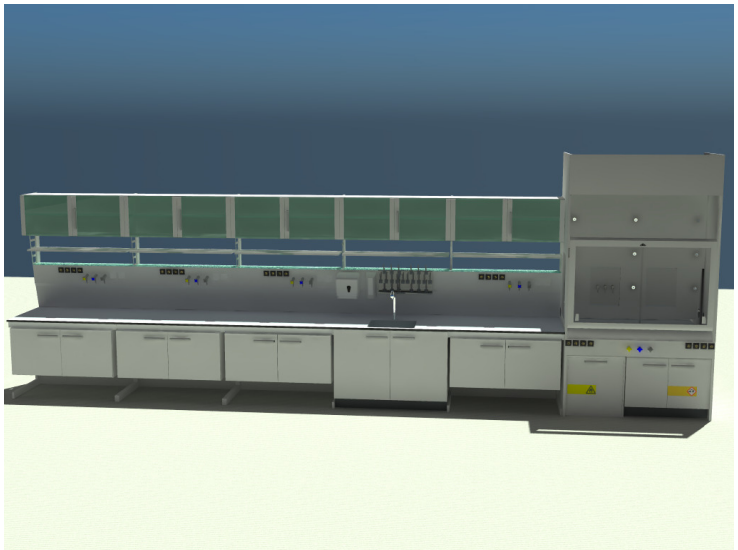
Tall Cabinets:

TYPE: O

5x1200mm wide
Glass door with height adjustable shelves



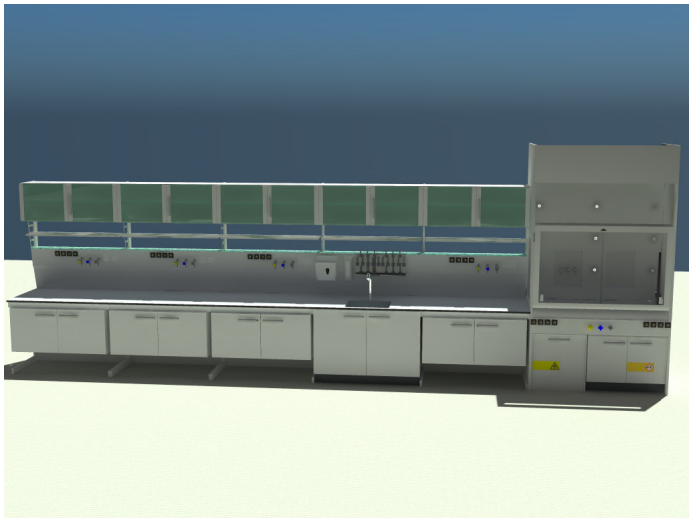
TYPE: P



Position Description: 102_Elevation_03

Wall Bench 1, & Fume Hood 1

Position Description: 102_Elevation_03



Wall Bench-01

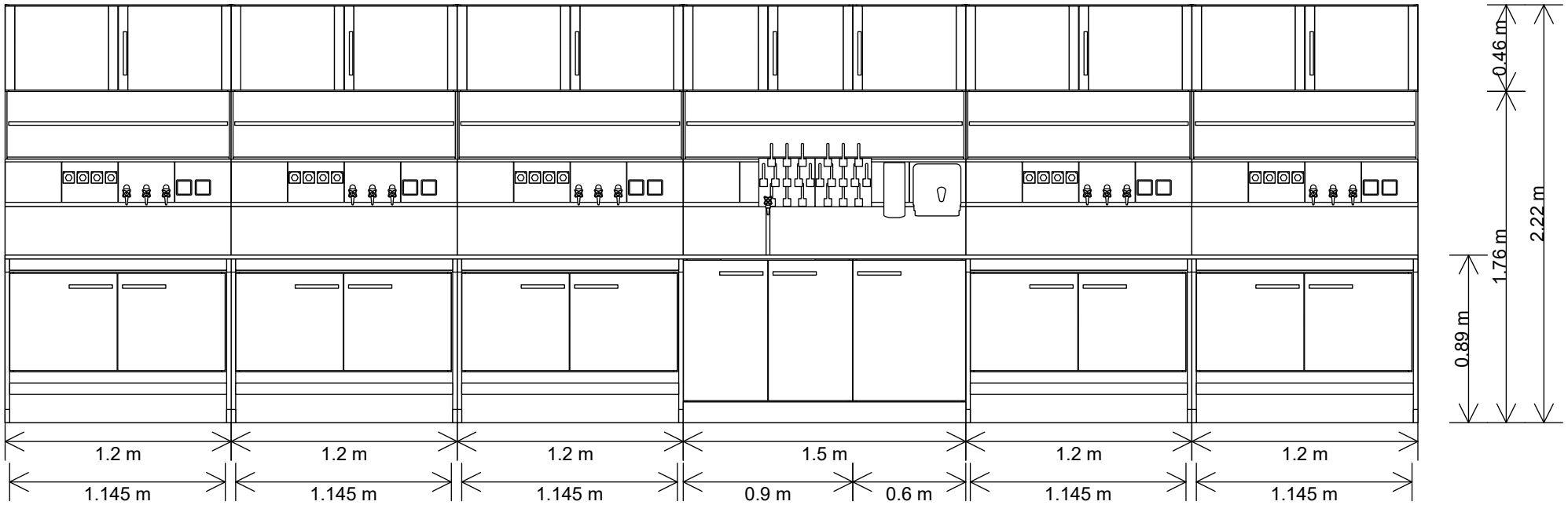
Length: 6000mm
Depth: 900mm
Working Height: 900mm

5x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,
4x 1200mm wide C-frame
4x 1200mm wide suspended Underbench cabinets with double doors
5x 1200mm wide spine mounted overhead cabinets with glass doors
1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser
& 2 peg boards & deep sink in PP
Services: 16x 125V Duplex GFCI receptacles , 8x Data sockets.
4x Lab Gas, 4x Oxygen, 4x Vacuum

Fume Hood_01:

Length: 1500mm
Depth: 900mm
Working Height: 900mm
Total Height: 2700mm

Worktop: Industrial Ceramic/Stoneware
Airflow Monitor: FAZ; Cable port: Right side, Glass view panel: Ride side wall
Inner liner: SGL
UB: 1x Solvent, 1x Acid Storage Cabinet
Services: 8x 125V Duplex GFCI,
1x Lab Gas, 1x Oxygen, 1x Vacuum



Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

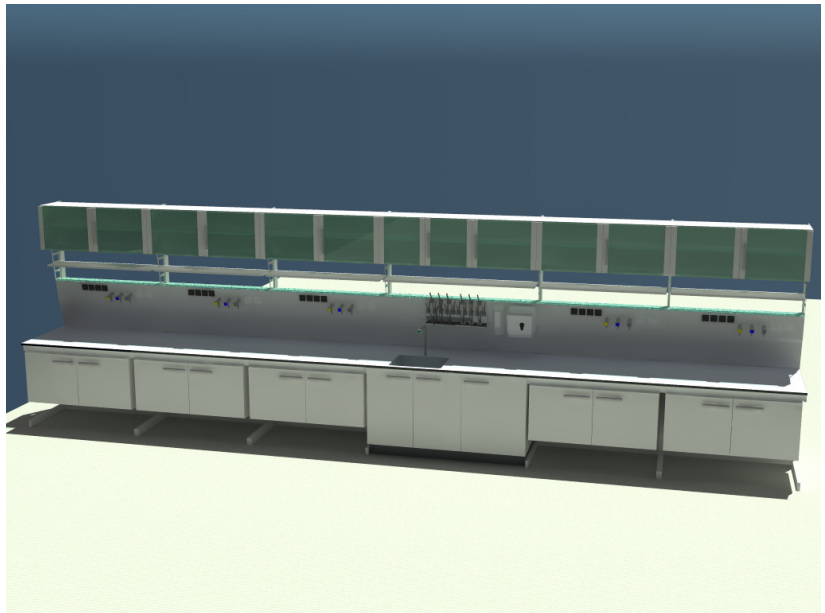
Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
1xVE Outlet tap

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)



Position Description: 102_Elevation_04

Wall Bench 2

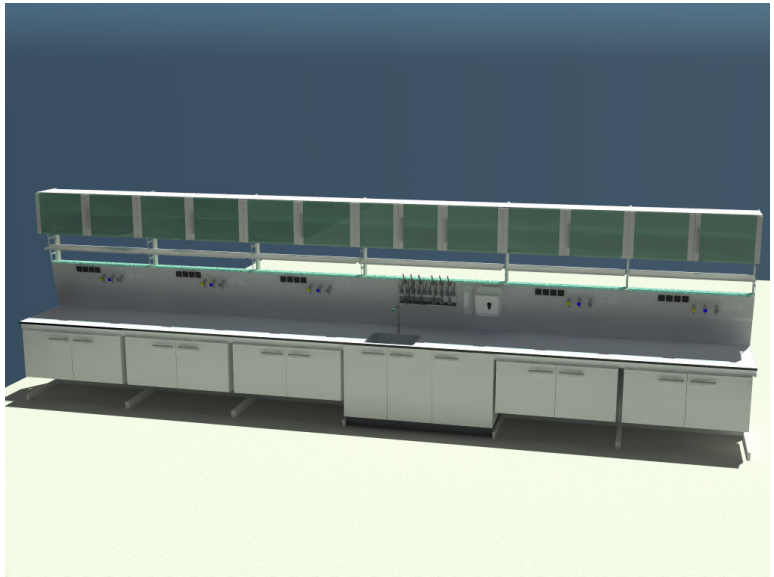
TYPE: Q

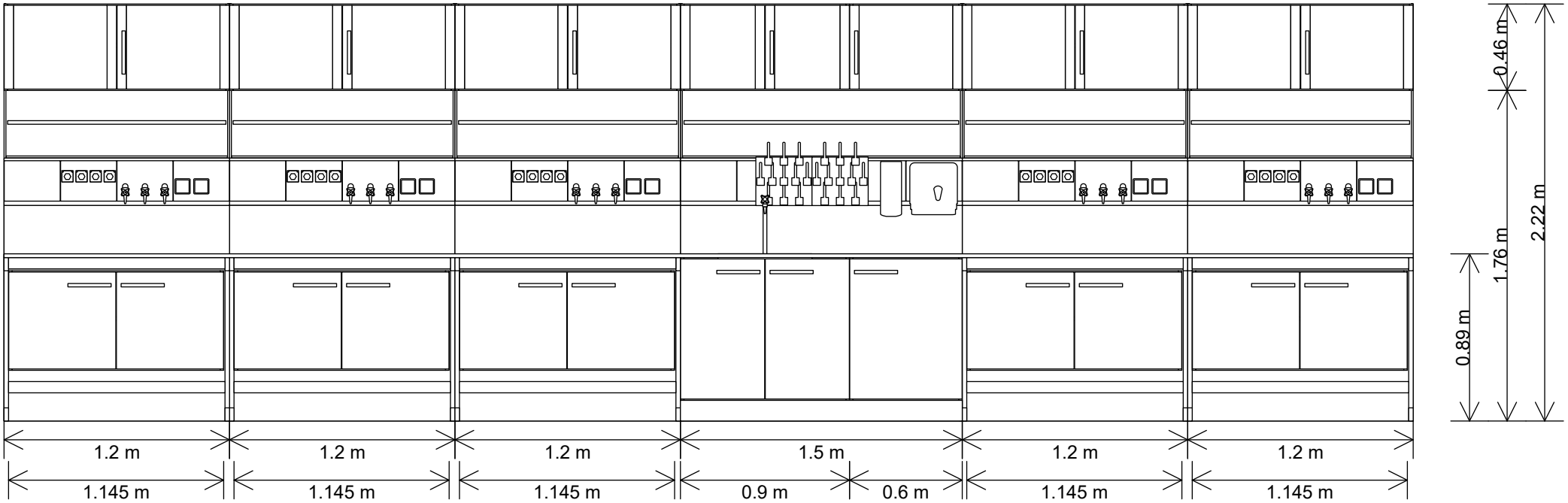
Position Description: 102_Elevation_04

Wall Bench-02

Length: 75000mm
Depth: 900mm
Working Height: 900mm

5x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,
1x 1500mm wide Single Sided service spine with shelving, Complete TRESPA WT
5x 1200mm wide C-frame
5x 1200mm wide suspended Underbench cabinets with double doors
6x 1200mm wide spine mounted overhead cabinets with glass doors
1X 900mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser
1x 600mm wide UB on plinth next to sink with waste bins
& 2 peg boards & deep sink in PP
Services: 20x 125V Duplex GFCI receptacles , 10x Data sockets.
5x Lab Gas, 5x Oxygen, 5x Vacuum





Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

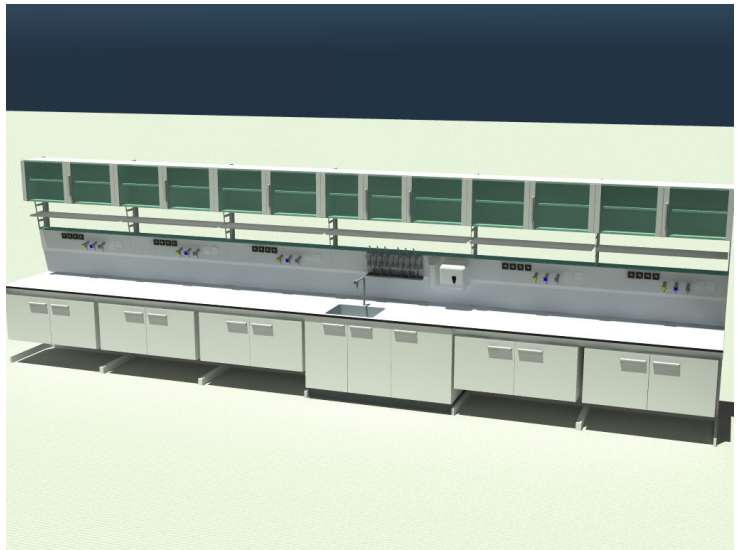
Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
1xVE Outlet tap

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)



Position Description: 102_Elevation_06

Wall Bench 3

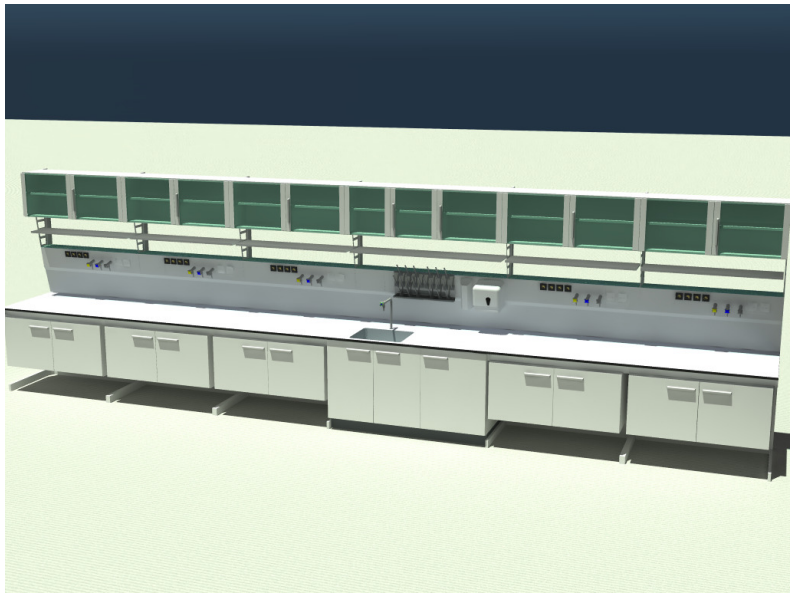
TYPE: R

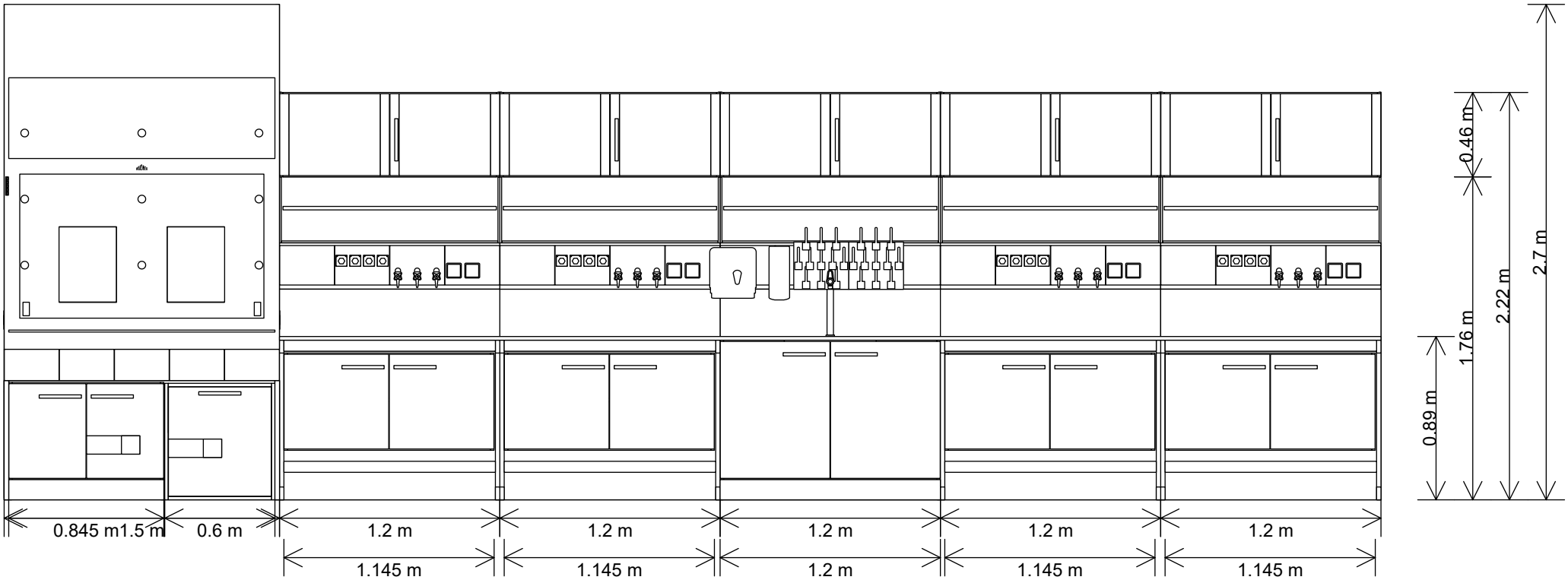
Position Description: 102_Elevation_06

Wall Bench-03

Length: 75000mm
Depth: 900mm
Working Height: 900mm

5x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,
1x 1500mm wide Single Sided service spine with shelving, Complete TRESPA WT
5x 1200mm wide C-frame
5x 1200mm wide suspended Underbench cabinets with double doors
6x 1200mm wide spine mounted overhead cabinets with glass doors
1X 900mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser
1x 600mm wide UB on plinth next to sink with waste bins
& 2 peg boards & deep sink in PP
Services: 20x 125V Duplex GFCI receptacles , 10x Data sockets.
5x Lab Gas, 5x Oxygen, 5x Vacuum





FAZ

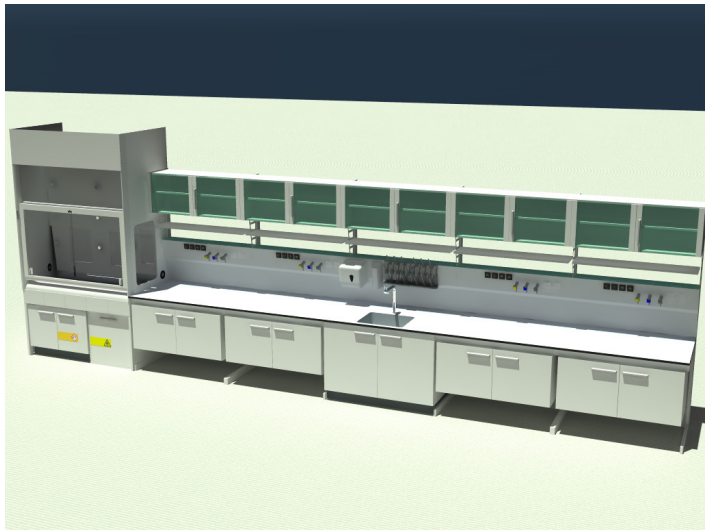
Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
1xSingle lever mixer tap

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

Services:
2xData
1xG (Technical)
1xO2 (Technical)
4xSocket
1xVA (Technical)

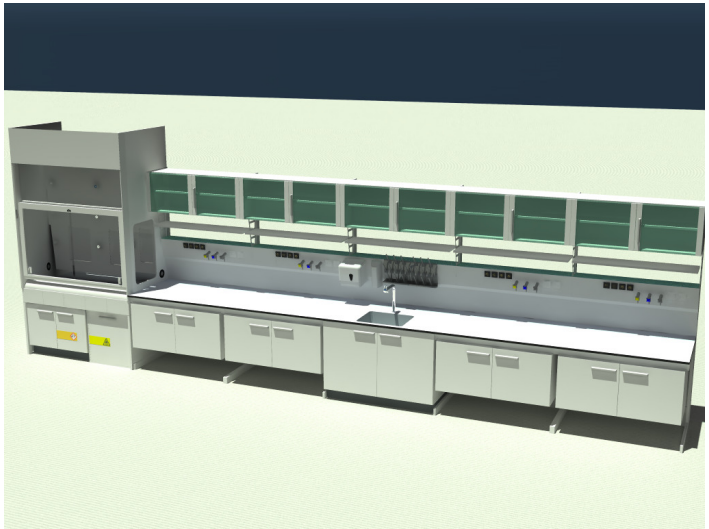


Position Description: 102_Elevation_07

Wall Bench 4, & Fume Hood 2

TYPE: S

Position Description: 102_Elevation_07



Wall Bench-04

Length: 6000mm
Depth: 900mm
Working Height: 900mm

5x 1200mm wide Single Sided service spine with shelving, Complete TRESPA WT,
4x 1200mm wide C-frame
4x 1200mm wide suspended Underbench cabinets with double doors
5x 1200mm wide spine mounted overhead cabinets with glass doors
1X 1200mm wide Sink UB with single lever mixer tap, soap dispenser, towel dispenser
& 2 peg boards & deep sink in PP
Services: 16x 125V Duplex GFCI receptacles , 8x Data sockets.
4x Lab Gas, 4x Oxygen, 4x Vacuum

Fume Hood_02

Length: 1500mm
Depth: 900mm
Working Height: 900mm
Total Height: 2700mm

Worktop: Industrial Ceramic/Stoneware
Airflow Monitor: FAZ; Cable port: Right side, Glass view panel: Ride side wall
Inner liner: SGL
UB: 1x Solvent, 1x Acid Storage Cabinet
Services: 8x 125V Duplex GFCI,
1x Lab Gas, 1x Oxygen, 1x Vacuum

SECTION 12 48 13

ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Entrance mats.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Floor depression formed with a frame.

1.2 SUBMITTALS

A. Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit shop drawings indicating dimensions.

C. Submit product data indicating mat characteristics, component dimensions, recessed frame and details.

D. Submit two samples 4" x 4" in size illustrating pattern, color, finish, and edging.

E. LEED Submittals: Product data indicating performance of multi-zone entrance mat system to reduce tracked-in dirt.

1.3 OPERATION AND MAINTENANCE DATA

A. Submit maintenance data under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

B. Include cleaning instructions, and stain removal procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials in accordance with the requirements of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design shall be **Balco, Inc. - FMR-C** with aluminum frame and carpet inserts. (ph. 800-767-0082) Equivalent product of the following manufacturers are acceptable:
   Reese Enterprises,
   Inc. JL Industries, Inc.

2.2 MATERIALS

A. Aluminum tread rails spaced at 2" o.c., connected by a vinyl hinge. Treads to run counter to traffic flow with tread surfaces of carpet. Provide with a recessed dark anodized aluminum frame set in the concrete.

B. Finish: Tread rails and recessed frame to be fabricated of 6063-T5 alloy in clear anodized.

Embedded parts to have a shop coat of clear acrylic. Anchors furnished at 24" o.c.

C. Surface Treads:
   1. Carpet: Tread rails shall have 100% nylon fiber face. Carpet with ¼" finish pile height, 30 oz./sq. yd. is to be unitary fusion bonded to guard against fraying, delamination or moisture penetration. Carpet to be positively locked into extruded aluminum tread rails. Colors to be selected by Architect.
   2. Vinyl: Fillers and hinges to be PVC. Vinyl tread to be PVC with continuous cross-hatched design positively locked into aluminum tread rails. Colors to be selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that floor openings are ready to receive work.

B. Verify field measurements are as shown on shop drawings and as instructed by the manufacturer.

C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Verify size of floor recess before fabricating mats.

B. Vacuum clean floor recess.

3.3 INSTALLATION

A. Mats shall be cut to fit indicated areas. Where used as floor finish, upper edge shall be level with adjacent finished floor surface.

B. Apply latex leveling material in recessed area in accordance with manufacturer’s instructions.

C. Install mats in floor recess flush with finish floor after final cleaning of finish flooring.

3.4 TOLERANCES

A. Maximum Gap Allowed Between Recessed Frame and Mat: 1/8".

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide and install handicapped parking signs, traffic directional signs, and bicycle racks.

B. Related Sections:
1. Section 101400 – Identifying Devices
2. Section 32 13 13 - Concrete Paving.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include catalog, cuts of each type of sign and manufacturer's installation instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle signs in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS
and in manufacturer's cartons. Store off ground on planking. Cover with non-staining plastic.

1.4 PROJECT CONDITIONS

A. Coordinate installation of site furnishings with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Site signs: As manufactured by Takeform 11601 Maple Ridge Rd., Medina, NY 14103 (phone 800-528-1398), or approved equivalent.
1. General: Site signs shall be of the quality manufactured by Takeform Reference Section 101400 Identifying Devices for additional coordination.
2. Aluminum Sheets: ASTM B 209, alloy 6061 T6, degreased and etched, 0.080" thickness. Sign faces shall be fully reflectorized with material conforming to Mil. Spec. MIL-R-13689A.
3. Bolts, Nuts, Washers, and Clamps: Cadmium or galvanized steel. Bolts shall be a minimum of 5/16" in diameter. Clamps shall be two-piece assemblies of at last 14 gage steel or shall be an adjustable steel strap bracket.
4. Posts: Standard galvanized steel pipe 2⅜" in diameter and weighing not less than 2 lbs. per linear foot.
5. Concrete: Provide concrete consisting of Portland cement (ASTM C 150), aggregates (ASTM C 33), and clean water. Mix materials t obtain concrete with a minimum 28-day compressive strength of 2500 psi, using at least 4 sacks of cement per cubic yard, 1" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

B. Bicycle Racks: Provide Model RB-11-I-G as manufactured by AAA Ribbon Rack Co., Division of Brandir International, Inc. (phone 212-505-6500) or Creative Pipe, Inc. (phone 800-644-8467) Thunderbolt Model TB11(E)(G). Bicycle racks shall be made from ASTM A 53, 2.375" o.d. x 0.154" wall, Schedule 40 galvanized steel pipe hydraulically bent with a mandril, hot dipped galvanized after fabrication.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Site Sign Materials:
   1. Excavation: Drill holes of the size indicated for posts. Excavate holes to the depths indicated. Remove excess concrete and excavated soil from the site.
   2. Setting Posts:
      a. Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete. Center and align posts in holes.

      b. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Trowel finish tops of footings, and slope or dome to direct water away from posts.
   3. Attach signs to posts with bolts, washers, nuts and clamps.

B. Bicycle Racks:
   1. Install bicycle racks in accordance with manufacturer's instructions at locations indicated on the drawings.
   2. Install bicycle racks level, plumb, square, accurately aligned, correctly located, and without warp.
   3. Measure centerline of end post to centerline of endpost to determine spacing for footing (holes).
   4. Embedded Mounting: Embed bicycle racks by direct burying. Prepare footings (holes) approximately 8" wide by 12" deep minimum in accordance with manufacturer's instructions.
   5. Use 1-1/2" high wood block for spacing between lower U-bends of rack and the ground.
   6. Use hardware and fasteners in accordance with manufacturer's instructions.
   7. Place rack in prepared holes, making sure lower U-bends are resting on the 1-1/2" high wood block.
   8. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
   9. Pour cement and level rack. Support until dry and remove wood block.
   10. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.2 CLEANING

A. Clean exposed sign faces and galvanized surfaces, and leave free of defects. Use no abrasives. Leave pavement and graded area clean and free of debris.

END OF SECTION

SECTION 14 21 23.16
MACHINE ROOM-LESS ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes Machine room-less electric traction passenger elevators as shown and specified. Elevator work includes:

1. Gearless electric traction passenger elevators.
2. Elevator car enclosures, hoistway entrances and signal equipment.
3. Operation and control systems.
4. Accessibility provisions for physically disabled persons.
5. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
6. Materials and accessories as required to complete the elevator installation.

B. Related Sections:

1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
4. Division 5 Metals:
   a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
   b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
6. Division 16 Sections:
   a. Providing electrical service to elevators, including fused disconnect switches where permitted. (Note: fused disconnect switch to be provided as part of elevator manufacture product)
   b. Emergency power supply, transfer switch and auxiliary contacts.
   c. Heat and smoke sensing devices.
   d. Convenience outlets and illumination in control room (if applicable), hoistway and pit.
7. Division 22 Plumbing
   a. Sump pit
8. Division 23 Heating, Ventilation and Air Conditioning
   a. Heating and ventilating hoistways and/or control room.

C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ASME A17.1 Code. For specific rules, refer to ASME A17.1, Part 2 for traction elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the TK Elevator’s proposal since it is a part of the building construction.

1. A plumb and legal hoistway, properly framed and enclosed an including a pit of proper depth, and a pit ladder for each elevator. Hoistway walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point. Drains, lights, access doors, waterproofing and hoistway ventilation, as required.
2. Elevator controller space

a. Door jamb controller option - controller landing wall thickness must be a minimum of 8 1/2 inches thick. This is due to the controller being mounted on the top floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Final location must be coordinated with elevator contractor. These requirements must be coordinated between the general contractor and the elevator contractor.
b. Control room option - provide a suitable control closet with access and ventilation in accordance with all applicable codes and regulations. The control closet shall be maintained at a temperature between 32 F (0 C) and 104 F (40 C). To be measured at 6 feet (1830 mm) above the floor and 1 foot (305 mm) out from the front center of the car controller(s). Relative humidity is not to exceed 95% non-condensing. Local codes may require tighter temperature ranges, and higher ventilation levels, please check with your local code authority for the exact requirements in your area. If your control closet temperatures exceed these requirements, contact your local TK Elevator sales representative for assistance. All telephone wiring to controller room control panel, and installation of telephone instrument or other communication equipment in elevator cab with all connections to elevator in controller room.

3. Hoistway must be maintained between 32ºF (0ºC) and 122ºF (50ºC) measured at the machine.
4. Adequate supports to carry the loads of all equipment, including overhead machine and machine beams located in hoistway including supports for guide rail brackets.
5. Complete 3 phase connections from the electric power mains to each controller, including necessary circuit breakers and fused mainline disconnect switches unless otherwise specified herein by elevator manufacture.
6. Electric power of the same characteristics as the permanent supply without charge for the construction, testing and adjusting.
7. Provide proper piping and conduit.
8. Divider beams for rail bracket support as required.
9. Cutting of walls floor, etc. and removal of such obstructions as may be necessary for proper installation of the elevator.
10. Grouting of door sills, hoistway frames, and signal fixtures after installation of the elevator equipment.
11. All painting, except as otherwise specified.
12. Provide hoistway walls designed and constructed in accordance with the required fire rating (including those places where elevator fixture boxes, rail bracket fastenings, and any other penetration into the hoistway walls).
13. Temporary enclosures, barricades and other protection from open hoistways and elevator work area during the time the elevator is being installed to meet all permanent installation safety codes. A temporary work platform to be provided at the top landing across the hoistway; if required, it should conform to all code and safety requirements.
14. Smoke detector /sensing devices and contacts wired to elevator control as required by local code. A means to automatically disconnect the main line power supply to the elevator prior to the application of water in the elevator controller room shall be furnished by the electrical contractor. This means shall not be self-resetting.
15. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.

16. A standby power source, including necessary transfer switches and auxiliary contact, where elevator operation from an alternate power supply is required.
17. Adequate storage facilities for elevator equipment prior to and during installation at ground level within 150 feet of hoistway.
18. Setting of anchors and sleeves.
19. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
20. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
21. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
22. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2019 areas) shall be provided at the same height, above sill of access door or handgrips.

1.02 SUBMITTALS

A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.

B. Shop drawings:
1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
4. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Paint selection: Submit manufacturer’s standard selection charts for exposed finishes and materials.

D. Integrated laminate selection: Submit manufacturer’s standard selection charts for exposed finishes and materials.

E. Metal Finishes: Upon request, standard metal samples provided.

F. Operation and maintenance data. Include the following:
1. Generic owner’s manuals and no wiring diagrams.
2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
1. The manufacturer of machines, controllers, signal fixtures, door operators, cabs, entrances, and all other major parts of elevator operating equipment.
   a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.

2. The manufacturer shall have a documented, on-going quality assurance program.
3. ISO-9001:2000 Manufacturer Certified
4. ISO-14001:2004 Environmental Management System Certified
5. LEED Gold certified elevator manufacturing facility.

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:
1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. NFPA 70 National Electrical Code.
3. NFPA 80 Fire Doors and Windows.
4. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
5. Section 407 in ICC A117.1, when required by local authorities
6. CAN/CSA C22.1 Canadian Electrical Code
7. CAN/CSA B44 Safety Code for Elevators and Escalators.

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:

1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Arrange for inspections and make required tests.
3. Deliver to the Owner upon completion and acceptance of elevator work.

F. Sustainable Product Qualifications:
1. Environmental Product Declaration:
   a. GOOD: If Product Category Rules (PCR) are not available, produce a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
   b. BEST: If Product Category Rules (PCR) are available, produce and publish an Environmental Product Declaration (EPD) based on a critically reviewed life-cycle assessment conforming to ISO 14044, with external verification recognized by the EPD program operator.
2. Material Transparency:
   a. GOOD: Provide Health Product Declaration at any level
   b. BETTER: Provide Health Product Declaration (HPD v2 or later). Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool.
   c. BEST: Cradle to Cradle Material Health Certificate v3, Bronze level or higher.
3. LEED v4 – Provide documentation for all Building Product Disclosure AND Optimization credits in LEED v4 for product specified.

1.04 DELIVERY, STORAGE AND HANDLING

A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.06 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.

1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Design based around TK Elevator’s EOX Self-Supported Machine Room-Less elevator.

B. Contact: Brian Baxter, M: 303-257-7354, E: brian.baxter@tkelevator.com

2.02 MATERIALS, GENERAL

C. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD.

D. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

E. Steel:

1. Shapes and bars: Carbon.
2. Sheet: Cold- and hot-rolled stainless steel sheet, galvanized.

3. Finish: Factory-applied paint for structural parts, painted for architectural parts. Color selection must be based on elevator manufacture's standard selections.

F. Integrated laminate: Decorative surface finishes, pressure sensitive, acrylic type, nominal 0.014" thickness. Laminate selection must be based on elevator manufacture's standard selections.

G. Flooring by others.

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and riveted/clinched. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Deflector Sheaves: None

C. Guide Rails: Dry, non-lubricated steel, fastened to the building with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Predefined buffer stands for 4' and 5' pit depths.

F. Machine: The hoisting machine shall be a compact energy efficient permanent magnet Gearless traction type, consisting of PMAC motor, brake and driving sheave mounted on a rigid bedplate in the top of the hoistway. A large solid, forged shaft shall serve as a support for the motor rotor assembly and for the drive sheave and brake system. It shall be supported by roller bearings mounted in the machine housing.

G. Drive System:
1. The drive system shall be of the Variable Voltage Variable Frequency (VVVF) regenerative.
2. The system shall be a vector controlled pulse-width modulated AC drive. The variable voltage variable frequency drive shall convert the AC power supply using a two-step process to a variable voltage variable frequency power supply for use by the hoist motor.
3. The speed control shall be by means of vector control providing direct torque and field excitation automatically provided by permanent magnet. A digital absolute velocity encoder shall be provided giving feedback to the controller on armature position and motor speed.
4. Dual solid state electronics (IGBT Insulated Gate Bipolar Transistor) in series shall be used in place of mechanical contactors.

H. Motor/Machine: The motor shall be PMAC, totally enclosed, non-ventilated with class "F" insulation. The motor armature shall be dynamically balanced and supported by roller bearings of ample capacity. The armature and driving sheave shall be properly balanced for smooth, high-speed elevator performance. The PM machine shall be mounted horizontally in the top of the hoistway in a unitized formed steel structure on bearing plates furnished by the elevator installer. The unitized formed steel structure shall be securely fastened to the supports supplied by other trades.

I. Brake: The brake shall be a spring applied electric brake; held open by an electro-magnet actuated by a digital brake controller and designed to make smooth, positive stops. The Brake shall be designed to automatically apply in the event of interruption of power supply from any cause. Operation and control of the brake shall be all digital. The setting and lifting of the brake shall be software based and all electronic. All adjustments and setup of the brake shall be made using a PC interface. No contactors or resistors shall be used in the actuation of the brake.

J. Suspension Belts and Governor Rope: Suspension belts shall be flat belts of polyurethane with an inner core of 14 steel cords with an FT1 fire rating such that hoistway sprinklers are not required by NFPA-13. Each belt shall have a suspension strength of 64 KN (14,388 pounds).

1. Three belts.
2. Suspension tension monitor shall detect differences in belt tension and for loss of tension. If fault is detected, the car shall stop at the nearest floor and an Out of Service call be registered.
3. Trip criteria shall be monitored, and data shall be stored in redundant non-volatile locations. Belts shall be replaced prior to the end of service life. Messages shall be issued at 180, 90, and 30 days prior to the last day of service life.
4. Governor ropes shall be of steel wire construction.
5. Any special tools, devices, software or equipment required for monitoring the wear of suspension shall be included with the installation of the equipment and become the property of the owner at time of elevator completion. This includes special ongoing monitoring systems, special tools and instruction needed to monitor the suspension system.

K. Counterweight: Counterbalance each elevator for smooth and economical operation by using steel and/or cement weights securely fastened in a steel counterweight frame. Counterweight shall equal the weight of the complete elevator car and approximately 50 percent of the specified capacity load.

L. Safety and Governor: Car safety shall be mounted on the bottom members of the car frame and be operated by a centrifugal speed governor. The governor shall be designed to cut off power to the motor and apply the brake whenever the governor indicates the car has excessive speed. The governor shall function when the car over speeds.

M. Emergency Terminal Limits: Place electric limit devices in the hoistway near the terminal landings. Limit switch(es) shall be designed to cut off the electric current and stop the car if it runs beyond either terminal landing.

N. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

2.04 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.

1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.

2. Communication failure indicator: A Communication failure is a jewel that is located in the jamb and lights up if the connection with the phone in the elevator becomes faulty. Communication failure is tested on the SIL3 rated devices by inspectors to ensure the car will not run or accept a car call when there is a loss of communication between the car and controller.
3. Main landing door & frame finish: with #4 Stainless Steel entrance frame.
4. Typical door & frame finish: with #4 Stainless Steel entrance frame.

B. Interlocks: Equip each hoistway entrance with an approved type of interlock, tested as required by code. Provide door restriction devices as required by code.

C. Door Hanger and Tracks: Provide sheave type two-point suspension hangers and tracks for each hoistway horizontal sliding door.

1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up thrust of the doors during operation.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

D. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.05 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:

1. Walls: Cab type, stainless steel. Wall panels shall be constructed of steel with integrated laminate panels. Columns shall be factory painted.
2. Canopy: Galvanized steel with chain rope exit.
3. Ceiling: Stainless steel downlight type, metal pans with suspended LED downlights. Number of downlights shall be dependent on platform size with a minimum of four. The metal pans shall be finished with a stainless steel, no. 4 brushed finish.
4. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel.
5. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
    a. Door Finish: Stainless steel.
    b. Cab Sills: Extruded, aluminum mill finish.
6. Support rail: Provide 1.5" (38 mm) diameter formed cylindrical metal bar on side and/or rear walls on front opening cars and side walls only on front and rear opening cars. Support rails shall have a stainless steel, no. 4 brushed finish.
7. Ventilation: Manufacturer’s standard exhaust fan, mounted on the car top. (Option Only)
8. Protection pads: Not required

B. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.06 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams supporting 2D or 3D light curtains per code. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.07 CAR OPERATING STATION

Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in a surface-mounted panel requiring no applied faceplate. COP shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED’s shall be included for

each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided. Visual highlight is the standard equipped, integrated multimedia display.

A. Emergency Communications System: Integral phone system provided. For improved accessibility, there are visual and acoustic confirmation for button inputs as well as a voice synthesizer for travel and floor announcements.

B. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate, and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

C. Special Equipment: Not Applicable

D. Digital Services: Cloud-based IoT monitoring system comes standard with these options:

Remote Monitoring with Application Programming Interface (API) Integration

ADA Phone - Code Compliant Cellular Connectivity

Smart Device Elevator Calling with occupant app API integration

E. Digitally Native: Digital expansion for evolving ecosystem of digitally augmented services. DEP infotainment display comes standard.

2.08 CONTROL SYSTEMS

A. Controller: The elevator control system shall be microprocessor based and software oriented. The system shall operate in real time, continuously analyzing the car(s) changing position, condition, and work load. All controller and operational circuits including the brake control and drive system shall be digital. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

1. Momentary pressing of one or more buttons shall dispatch the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed. Each landing call shall be canceled when answered.
2. When the car is traveling in the up direction, it shall stop at all floors for which car buttons or "up" hall buttons have been pressed. The car shall not stop at floors where "down" buttons have been pressed, unless the stop for that floor has been registered by a car button or unless the down call is at the highest floor for which any buttons have been pressed. Pressing the "up" button when the car is traveling in the down direction shall not intercept the travel unless the stop for that floor has been registered by a car button or unless the up call is the lowest for which any button has been pressed.

3. When the car has responded to its highest or lowest stop, and stops are registered for the opposite direction, its direction of travel shall reverse automatically and it shall then answer the calls registered for that direction. If both up and down calls are registered at an intermediate floor, only the call corresponding to the direction of car travel shall be canceled upon the stopping of the car at the landing.
4. A car that is stopping for the last hall call in the preference direction, and that hall call is for the opposite direction with no onward car calls, shall reverse preference when the selector position advances to the landing at which the car is committed to stop. A car that is stopping for the last hall call in the preference direction, and that hall call is for the same direction, shall hold its preference until the door is almost closed allowing time for a passenger to register an onward car call which shall maintain the preference. If no car call is registered before the door is almost closed, the car shall lose its preference and shall be available to accept calls in either direction.

B. Operation: Selective Collective – ETA based. The system is optimized to get a car to the floor where a hall call has been registered, in the shortest time. The system receives input information from standard call pushbuttons located in the hall, car position and car load information from individual car load weighers.

1. When group operation is required, the group supervisory operation shall be embedded within selected car controllers. No separate group controller shall be supplied. The microprocessor shall constantly scan the system for hall calls. When hall calls are registered, the control system shall immediately calculate the estimated time for arrival using such information as, number of floors to travel from the current position, the time it takes to travel one floor at top speed, calls assigned to a car, and car reversal time to respond to a call in the opposite direction of travel. When a car's status changes or additional hall calls are registered, the estimated time of arrival shall be recalculated and calls reassigned if necessary.
2. Traffic Pattern: The microprocessor shall provide flexibility to meet well defined patterns of traffic, including up peak, down peak, and heavy interfloor demands, and adjust for indeterminate variations in these patterns which occur in buildings.
3. Artificial Intelligence: Artificial Intelligence shall be an integral part of the group control system software. The enhanced artificial intelligence shall optimize the interfloor traffic performance. Inputs for the artificial intelligence shall include accurate passenger load from an electronic loadweigher, probable car calls generated from each hall call, type of building and observed traffic patterns.

C. Load Weighing Device: Provide a load weighing device on each car which, when the particular car is filled to an adjustable percentage of the capacity load, shall cause the car to bypass landing calls but not car calls. The passed landing calls shall remain registered for the next following car.

1. The device shall be unaffected by the action of compensating chain or rope. The device shall detect a 50-pound (23 Kg.) load change under all conditions.
2. The load sensor shall use a load cell to accurately measure the weight in the car. The information shall be transferred via a serial link to the elevator controller.

D. Anti-Nuisance Call Control: The microprocessor control system shall evaluate the number of people on the car and compare that value to the number of car calls registered. If the number of car calls exceeds the number of people by a field programmable value, the car calls shall be canceled after the first call has been answered.

E. Position Selector: The position selector shall be part of the microprocessor system. The car position in the hoistway shall be digitized through a primary position encoder. The microprocessor control system shall store the floor position and slow down points in memory.

F. Motion Control: The drive control system shall be dual-loop feedback system based primarily on car position. The velocity profile shall be calculated by the microprocessor control system producing extremely smooth and accurate stops. The velocity encoder shall permit continuous comparison of machine speed to velocity profile and to actual car speed. This accurate position/velocity feedback shall permit a fast and accurate control of acceleration and retardation.

G. Motor Pre-Torque: Current shall be applied to the elevator drive before the brake is released and the speed pattern is dictated to eliminate roll back and sling shot effects of unbalanced loads in the car. The electronic loadweigher shall determine the load on the car determining a pre-torque reference to send to the drive.

H. Emergency Power Operation: In the event of power loss, this elevator(s) should be equipped with a battery powered automatic rescue operation device. This operation is designed to only move the car up or down to the nearest landing depending on the load in the car. It is NOT designed to lower the car to a specified landing such as Battery Lowering used for Hydraulic applications. An isolation transformer is required if the building voltage is NOT 480VAC. A single rescue unit is not capable of rescuing a group of cars --- this is a per car option. Maximum travel on rescue operation is 100 feet. Average time of operation for Rescue is 3 minutes. This feature is only available for jobs with 60HP and below. This battery automatic rescue operation is not allowed with the Green Drive.

I. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

J. Special Operation: Not Applicable

K. Digital Services:

Cloud-based IoT Monitoring System (standard): Contractor shall provide a cloud-based IoT (internet of things) monitoring system capable of tracking door movements and timing, trips, power cycles, car calls, out-of-service events and modes. This observation will continue 24/7 and it shall be capable of providing service technicians a minimum of three recommended solutions for defined failure events and automatically dispatch service technicians in the event of failure(s) while sending notifications to end users of changes in their equipment's state via both email and mobile device. Access to IoT and related equipment data and status will be made available in both a web portal and mobile application secured by password and username with at least two-factor authentication. Finally, this system must be self-contained and not require internet provision by others.

Along with the monitoring system, options are available.

Remote Monitoring with Application Programming Interface (API) Integration: Contractor shall

provide a portal and mobile device application (app) that communicates relevant service and operational information such as elevator operational status, open service call tickets, call ticket history and performance and service history. This system shall provide a REST application programming interface (API) capable of transmitting relevant information from the cloud-based IoT monitoring system. This data includes equipment operational status, door movements, service and maintenance history, traffic statistics and failure alerts.

ADA Phone – Code Compliant Cellular Connectivity: Contractor shall provide a phone service through a self-contained cellular based VoIP system. This system shall meet code, include a backup battery capable of powering the emergency communication equipment for 4+ hours in the event of a power outage. The solution shall have remote monitoring capability to ensure continuous connectivity with a means of remote troubleshooting. Remote monitoring capability shall include, at a minimum, the ability to monitor connectivity and power supply. Remote monitoring shall be capable of providing local alerts to response personnel when on-site intervention is required.

Smart Device Elevator Calling with Occupant app API Integration: Contractor will provide an elevator calling application for smart devices (app) that can be accessed through Android and IOS smart device operating systems. This calling service shall be accomplished on both, Destination Dispatch and Traditional ETA elevator control system applications. Furthermore, a single, common and consistent app shall have the same user experience and user interface on both Destination Dispatch and Traditional ETA dispatching control systems. To enable mobile calling functionality without creating unnecessary wear on elevator components resulting from false calls, proximity detection beacons shall be installed in the elevator lobby at each floor. These beacons shall detect user smart devices and restrict calling of elevators when the user is not within a pre-configured range of elevator entrance. Beacon-based proximity detection distance must be configurable to accommodate various building and floor layouts. Once Bluetooth signal is detected, the user can place a floor call directly from their handheld or wearable device. The elevator calling app shall remove the need for interaction with hall fixtures, buttons or kiosks. This system shall be capable of placing an automatic call to a user-configured destination floor automatically based on both location in building (floor) and time of day. App users shall be able to configure their own source or starting floor, destination floor and schedule of automatic calling service, and be able to configure multiple automatic calling services and routines. System shall have reasonable ability to auto-provision users from access control system and not require duplicate entry of users for access control purposes. Finally, all services above shall be made available via an application programming interface (API) so that a 3rd party or tenant occupant app could be integrated with elevator smart device calling service so that users could receive multiple occupant experience-based services in a single, common, 3rd party mobile device application (app).

L. Digitally Native:

EOX has all the components needed for digital expansion from day one. No additional technician dispatching. On-site installation or modernization is required to enable new digital services giving you confidence that your elevator will remain up-to-date for years to come. It is born digital, connected to TK Elevator's evolving ecosystem of digitally augmented services.

2.09 HALL STATIONS

A. Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction.

1. Provide one pushbutton riser with faceplates having a brushed stainless steel finish, surface-mounted in the entrance jamb.
    a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the entrance frame at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Combo Hall Lantern and Position Indicator: An electronic position indicator shall be provided and mounted for optimal viewing. As the car travels, its position in the hoistway shall be indicated by the illumination of the alphanumeric character corresponding to the landing which the elevator is stopped or passing. Hall lantern is combined in the display with the directional arrow to indicate the travel direction in the same faceplate. Faceplates shall match the hall stations.

D. Special Equipment: Not Applicable

2.10 CONTROLLER LOCATION

A. Door Jamb Mount is integrated with controller in the door jamb. Control power and cab light are provided by the elevator contractor and included with the integrated assembly. Main power disconnect is provided by the general contractor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.

1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
2. Comply with the National Electrical Code for electrical work required during installation.

B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.

C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.

D. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.

E. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

I. Lubricate operating parts of system, including ropes, as recommended by the manufacturer.

3.03 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.

1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

A. Elevator Qty. 1

1. Elevator Model: EOX
2. Elevator Type: Gearless Traction Machine Room-Less, Passenger
3. Rated Capacity: 3500 lbs.
4. Rated Speed: 150 ft./min.
5. Operation System: EOX controller
6. Travel: 20'-0"
7. Landings: 2 total
8. Openings:
   a. Front: 2
   b. Rear: 0
9. Clear Car Inside: 6'-9" wide x 5'-5" deep
10. Inside clear height: 7'-4" standard
11. Door clear height: 7'-0" standard
12. Hoistway Entrance Size: 3'-6" wide x 7'-0" high
13. Door Type: One-speed | LH Side opening
14. Power Characteristics: 480 volts, 3 Phase, 60 Hz.
    a. Note: Isolation Transformer required for jobs with less than 460vac as well as 575vac, 3 Phase building power.
15. Seismic Requirements: Yes
16. Hoistway Dimensions: 8'-8" wide x 6'-9" deep (Non-Seismic)

a. Note: Hoistway dimensions listed above are for Non-Seismic areas only. If you have chosen the option for seismic requirements, please consult your local TK Elevator Sales Representative for the proper hoistway dimensions.

17. Pit Depth: 4'-0"
18. Clear Overhead: 12’-7”
19. Button & Fixture Style: EOX Signal Fixtures
20. Special Operations: None
21. Digital Services:
    Remote Monitoring with Application Programming Interface (API) Integration

    ADA Phone - Code Compliant Cellular Connectivity

    Smart Device Elevator Calling with occupant app API integration

22. Digitally Native

3.09 SPECIAL CONDITIONS (Note: Add Special Conditions as Needed)

END OF SECTION

SECTION 14 24 00
MACHINE ROOM-LESS HYDRAULIC PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Machine room-less hydraulic passenger elevators as shown and specified. Elevator work includes:
   1. Standard pre-engineered hydraulic passenger elevators.
   2. Elevator car enclosures, hoistway entrances and signal equipment.
   3. Operation and control systems.
   4. Jack(s).
   5. Accessibility provisions for physically disabled persons.
   6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
   7. Materials and accessories as required to complete the elevator installation.

B. Related Sections:
   1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
   2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
   3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
   4. Division 5 Metals:
      a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
      b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
   5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
   6. Division 16 Sections:
      a. Providing electrical service to elevators, including fused disconnect switches where permitted. (note: fused disconnect switch to be provided as part of elevator manufacture product, see section 2.11 Miscellaneous elevator components for further details.)
      b. Emergency power supply, transfer switch and auxiliary contacts.
      c. Heat and smoke sensing devices.
      d. Convenience outlets and illumination in control room (if applicable), hoistway and pit.
   7. Division 22 Plumbing
      a. Sump pit and oil interceptor.
   8. Division 23 Heating, Ventilation and Air Conditioning
      a. Heating and ventilating hoistways and/or control room.

C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the TK Elevator's proposal, since it is a part of the building construction.
   1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.

2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. All wire and conduit should run remote from the hoistways.
10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 1/2 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand

frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.

25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

1.02 SUBMITTALS

A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.

B. Shop drawings:
   1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
   2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
   3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
   4. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Powder Coat paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.

D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and materials.

E. Metal Finishes: Upon request, standard metal samples provided.

F. Operation and maintenance data. Include the following:
   1. Owner's manuals and wiring diagrams.
   2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
   1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
      a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.
   2. The manufacturer shall have a documented, on-going quality assurance program.
   3. ISO-9001:2000 Manufacturer Certified
   4. ISO-14001:2004 Environmental Management System Certified
   5. LEED Gold certified elevator manufacturing facility.

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:
   1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
   2. Building Code: National.
   3. NFPA 70 National Electrical Code.
   4. NFPA 80 Fire Doors and Windows.
   5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
   6. Section 407 in ICC A117.1, when required by local authorities
   7. CAN/CSA C22.1 Canadian Electrical Code
   8. CAN/CSA B44 Safety Code for Elevators and Escalators.
   9. California Department of Public Health Standard Method V1.1–2010, CA Section 01350

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:

   1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
   2. Arrange for inspections and make required tests.
   3. Deliver to the Owner upon completion and acceptance of elevator work.

F. Sustainable Product Qualifications:
   1. Environmental Product Declaration:
      a. GOOD: If Product Category Rules (PCR) are not available, produce a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
      b. BEST: If Product Category Rules (PCR) are available, produce and publish an Environmental Product Declaration (EPD) based on a critically reviewed life-cycle assessment conforming to ISO 14044, with external verification recognized by the EPD program operator.
   2. Material Transparency:
      a. GOOD: Provide Health Product Declaration at any level
      b. BETTER: Provide Health Product Declaration (HPD v2 or later). Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool.
      c. BEST: Cradle to Cradle Material Health Certificate v3, Bronze level or higher.
   3. LEED v4 – Provide documentation for all Building Product Disclosure AND Optimization credits in LEED v4 for product specified.
   4. Living Building Challenge Projects: Provide Declare label for products specified.

1.04 DELIVERY, STORAGE AND HANDLING

A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.06 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
   1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
   2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
   3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Design based around TK Elevator’s endura Machine Room-Less hydraulic elevator.
B. Contact: Brian Baxter, M: 303-257-7354, E: brian.baxter@tkelevator.com

2.02 MATERIALS, GENERAL

A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1–2010, CA Section 01350 as mentioned in 1.03.9 of this specification.

B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

C. Steel:
   1. Shapes and bars: Carbon.
   2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
   3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture’s standard selections.

D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.

E. Flooring by others.

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless. Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper viscosity grade inherently biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)

I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform "flooded pit operation", which will run the car up to the designated

floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.04 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
   1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
   2. An oil hydraulic pump.
   3. An electric motor.
   4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
   1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
   2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
   3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
   4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
   5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
   6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
   7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)

8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
   1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
   2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.
   3. Typical door & frame finish: Stainless steel panels, no. 4 brushed finish with no. 4 brushed finish entrance frame.

B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.

C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details

D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
   1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
   2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
   3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:
   1. Walls: Cab type TKAP, reinforced cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical wood core panels covered on both sides with high pressure plastic laminate.
   2. Reveals and frieze: a. Reveals and frieze: Powder Coated
   3. Canopy: Cold-rolled steel with hinged exit.
   4. Ceiling: Suspended type, LED lighting with translucent diffuser mounted in a metal frame. Framework shall be finished with a factory applied powder coat finish.

5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel
6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
   a. Door Finish: Stainless steel panels: No. 4 brushed finish.
   b. Cab Sills: Extruded aluminum, mill finish.
7. Handrail: Provide 2' flat metal bar on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
8. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
9. Protection pads and buttons: Provide one set of vinyl protection pads with metal grommets for the project. Provide pad buttons on cab front(s) and walls.

B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.
   1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
   2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
   3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
   4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection

system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.

5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED’s shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Auxiliary Operating Panel:

D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

E. Special Equipment: Not Applicable

F. Digital Services: Cloud-based IoT monitoring system comes standard with these options:

Remote Monitoring with Application Programming Interface (API) Integration

ADA Phone - Code Compliant Cellular Connectivity

A17.1 2019 Code - Enhanced Communications

Smart Device Elevator Calling with occupant app API integration

2.09 CONTROL SYSTEMS

A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
   1. Access to main control board and CPU
   2. Main controller diagnostics
   3. Main controller fuses
   4. Universal Interface Tool (UIT)
   5. Remote valve adjustment
   6. Electronic motor starter adjustment and diagnostics
   7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
   8. Operation of auxiliary pump/motor (secondary hydraulic power source)
   9. Operation of electrical assisted manual lowering
   10. Provide male plug to supply 110VAC into the controller
   11. Run/Stop button

C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.

E. Special Operation: Not Applicable

F. Digital Services:

   Cloud-based IoT Monitoring System (standard): Contractor shall provide a cloud-based IoT (internet of things) monitoring system capable of tracking door movements and timing, trips, power cycles, car calls, out-of-service events and modes. This observation will continue 24/7 and it shall be capable of providing service technicians a minimum of three recommended solutions for defined failure events and automatically dispatch service technicians in the event of failure(s) while sending notifications to end users of changes in their equipment's state via both email and mobile device. Access to IoT and related equipment data and status will be made available in both a web portal and mobile application secured by password and username with at least two-

factor authentication. Finally, this system must be self-contained and not require internet provision by others.

Along with the monitoring system, options are available.

Remote Monitoring with Application Programming Interface (API) Integration: Contractor shall provide a portal and mobile device application (app) that communicates relevant service and operational information such as elevator operational status, open service call tickets, call ticket history and performance and service history. This system shall provide a REST application programming interface (API) capable of transmitting relevant information from the cloud-based IoT monitoring system. This data includes equipment operational status, door movements, service and maintenance history, traffic statistics and failure alerts.

ADA Phone – Code Compliant Cellular Connectivity: Contractor shall provide a phone service through a self-contained cellular based VoIP system. This system shall meet code, include a backup battery capable of powering the emergency communication equipment for 4+ hours in the event of a power outage. The solution shall have remote monitoring capability to ensure continuous connectivity with a means of remote troubleshooting. Remote monitoring capability shall include, at a minimum, the ability to monitor connectivity and power supply. Remote monitoring shall be capable of providing local alerts to response personnel when on-site intervention is required.

A17.1 2019 Code – Enhanced Communications: For jobs installed under enforcement of 2018 International Building Code or ASME A17.1-2019/CSA B44:19 Safety Code, contractor will provide a video camera necessary for viewing the elevator cab interior floor as well as a position indicator display in the cab operating panel capable of providing means of two-way, text-based communication when the emergency call button is engaged in the elevator car. These components, and associated cloud-based monitoring platform, will be non-proprietary in nature, allowing customization on where to direct emergency calls, while offering capability for any party to provide the emergency monitoring services.

Smart Device Elevator Calling with Occupant app API Integration: Contractor will provide an elevator calling application for smart devices (app) that can be accessed through Android and IOS smart device operating systems. This calling service shall be accomplished on both, Destination Dispatch and Traditional ETA elevator control system applications. Furthermore, a single, common and consistent app shall have the same user experience and user interface on both Destination Dispatch and Traditional ETA dispatching control systems. To enable mobile calling functionality without creating unnecessary wear on elevator components resulting from false calls, proximity detection beacons shall be installed in the elevator lobby at each floor. These beacons shall detect user smart devices and restrict calling of elevators when the user is not within a pre-configured range of elevator entrance. Beacon-based proximity detection distance must be configurable to accommodate various building and floor layouts. Once Bluetooth signal is detected, the user can place a floor call directly from their handheld or wearable device. The elevator calling app shall remove the need for interaction with hall fixtures, buttons or kiosks. This system shall be capable of placing an automatic call to a user-configured destination floor automatically based on both location in building (floor) and time of day. App users shall be able to configure their own source or starting floor, destination floor and schedule of automatic calling service, and be able to configure multiple automatic calling services and routines. System shall have reasonable ability to auto-provision users from access control system and not require duplicate entry of users for access control

purposes. Finally, all services above shall be made available via an application programming interface (API) so that a 3rd party or tenant occupant app could be integrated with elevator smart device calling service so that users could receive multiple occupant experience-based services in a single, common, 3rd party mobile device application (app).

2.10 HALL STATIONS

A. Hall Stations, General: Vandal resistant buttons with center jewels which illuminate to indicate that a call has been registered at that floor for the indicated direction. Each button shall be provided with an internal automatic stop to prevent damage of switches that register the call. Provide 1 set of pushbutton risers. All fixtures shall be vandal resistant type.
   1. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
      a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Hall Position Indicator: Not Applicable

D. Hall lanterns: Not Applicable

E. Special Equipment:
   Limited access operation: Not Applicable

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.

C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

PART 3 EXECUTION

3.01 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator

installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.
   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.

B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.

C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.

D. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.

E. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

I. Lubricate operating parts of system, where recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing

regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
   1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

A. Elevator Qty. 1
   1. Elevator Model: endura MRL Twinpost above-ground 1-stage
   2. Elevator Type: Hydraulic Machine Room-Less, Passenger
   3. Rated Capacity: 4500 lbs.
   4. Rated Speed: 150 ft./min.
   5. Operation System: TAC32H
   6. Travel: 20’-0”
   7. Landings: 2 total
   8. Openings:
      a. Front: 2
      b. Rear: 0
   9. Clear Car Inside: 5'-8" wide x 7'-9 1/2" deep
   10. Inside clear height: 7'-4" standard
   11. Door clear height: 7'-0" standard
   12. Hoistway Entrance Size: 4'-0" wide x 7'-0" high
   13. Door Type: Two-speed | LH Side opening
   14. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
   15. Seismic Requirements: Zone 1
   16. Hoistway Dimensions: 7'-4" wide x 9'-6 1/2" deep
   17. Pit Depth: 4'-0"
   18. Overhead: 12’-8” underside of safety beam
   19. Button & Fixture Style: Vandal Resistant Signal Fixtures
   20. Special Operations: None
   21. Digital Services:
       Remote Monitoring with Application Programming Interface (API) Integration

       ADA Phone - Code Compliant Cellular Connectivity

       A17.1 2019 Code - Enhanced Communications

       Smart Device Elevator Calling with occupant app API integration

3.09 SPECIAL CONDITIONS (Note: Add Special Conditions as Needed)

END OF SECTION

SECTION 21 00 00 FIRE SUPPRESSION INDEX

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Fire Suppression Work, as indicated on the Drawings and specified herein. Fire Suppression work indicated on the Drawings and/or specifications covering other trades shall conform to Division 21 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Fire Suppression systems, shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for fire suppression service and control connections to all the various items of equipment requiring fire suppression service throughout the project shown on the Contract Drawings (even if not shown on the Fire Suppression Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 FIRE SUPPRESSION DIVISION INDEX

21 05 00	GENERAL FIRE SUPPRESSION REQUIREMENTS
21 13 00	AUTOMATIC SPRINKLER SYSTEMS

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 21 05 00 GENERAL FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General Mechanical Requirements specifically applicable to Division 21 sections in addition to Division 1 - General Requirements.

B. Scope:
   1. The work covered by this division consists of performing all operations in connection with the installation of fire protection systems including site utility work as indicated under this section. This entire section applies to all fire protection systems work and shall be coordinated with all mechanical sections of these specifications. This Contractor shall read and comply with all sections of these specifications including all General and Special Conditions.
   2. The contract documents, including all mechanical, electrical, and plumbing drawings and specifications, are part of this specification by reference.

1.2 REFERENCES

A. Standard Requirements:
   1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. All work shall be executed in accordance with the local and state codes, ordinances, and regulations governing the particular class of work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Where these specifications and accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect/Engineer. The Architect/Engineer shall prepare any supplementary drawings required, illustrating how the work may be installed so as to comply. On approval of the change by the Architect/Engineer, the Contractor shall install the work in a satisfactory manner without additional cost to the Owner. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved, and on completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Architect/Engineer.

C. The Contractor shall secure all permits and licenses for their work and shall pay all fees in connection with such permits and licenses.

D. The contractor shall hold and save the Owner free and harmless from liability of any nature or kind arising from their failure to comply with codes and ordinances.

E. Any and all meter deposits and all utility extension costs shall be paid by the Contractor whose work is done in connection with the service that the meter is connected to.

F. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:

1.	AABC	Associated Air Balance Council
2.	ADC	Air Diffusion Council 435 North Michigan Ave. Chicago, IL 60611
3.	AGA	American Gas Association 1515 Wilson Boulevard Arlington, VA 22209
4.	AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
5.	ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
6.	ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers 345 East 47th Street New York, NY 10017

7.	ASME	American Society of Mechanical Engineers 345 East 45th Street New York, NY 10017
8.	ASPE	American Society of Plumbing Engineers 960 Illuminating Building Cleveland, OH 44113
9.	ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
10.	AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
11.	AWS	American Welding Society 2501 NW 7th Street Miami, FL 33125
12.	CISPI	Cast Iron Soil Pipe Institute 1499 Chain Bridge Road McLean, VA 22101
13.	FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
14.	FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Building 197 Washington, DC 20407
15.	NBFU	National Board of Fire Underwriters 5530 Wisconsin Avenue, Suite 750 Chevy Chase, MD 20815
16.	NEC	National Electric Code (of NFPA)
17.	NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
18.	NEMA	National Electrical Manufacturer's Association 2101 L Street, NW Washington, DC 20037
19.	NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
20.	NSF	National Sanitation Foundation Box 1468 Ann Arbor, MI 48106
21.	OSHA	Occupational Safety and Health Administration U.S. Department of Labor
22.	PDI	Plumbing and Drainage Institute 5342 Boulevard Place Indianapolis, IN 46208
23.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association 8224 Old Courthouse Road Vienna, VA 22180
24.	TIMA	Thermal Insulation Manufacturers Association Technical Services 1420 King Street Alexandria, VA 22314
25.	UL	Underwriters Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

G. Underwriters Laboratories Inc. (UL): All materials, appliances, equipment, devices, or appurtenances shall conform to the applicable standards of Underwriters Laboratories Inc., where such standards have been established.

1.3 DRAWINGS

A. Drawings and specifications shall be considered as cooperative, and work or materials called for by one and not mentioned in the other, or vice versa, shall be done and furnished as though treated by both.

B. In the cases of discrepancies in figures, drawings, or specifications, the Architect/Engineer shall be notified immediately, and their decision shall determine the necessary adjustment. Without such decision, said discrepancies shall not be adjusted by the Contractor save only at their expense, and, in case of any settlement or any complication arising from such adjustment to the Contractor, they shall bear all extra expense involved.

C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Architect/Engineer for such further drawings or explanations as may be necessary, allowing a reasonable time for the Architect/Engineer to supply same, and the Contractor shall conform to same as part of the Contract.

D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Architect\Engineer whose decision shall be final and conclusive. No alleged oral admission, condonation, or inadvertent neglect on the part of the Architect/Engineer will be accepted as an excuse for inferior work.

E. The fire protection plans do not give exact details as to elevations of any ceilings, ductwork and piping, exact locations, etc., and do not show all offsets, control lines, pilot lines, and other installation details. The Contractor shall carefully lay out their work at the site to conform to the structural conditions, provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated, satisfactory operational installation.

F. Should the particular equipment which any Bidder proposes to install require other space conditions than those indicated on the drawings, the Bidder shall arrange for such space with the Architect/Engineer before submitting their bid. Should changes become necessary on account of failure to comply with these details, the Contractor shall make such necessary changes at their (the Contractor's) own expense.

G. The Contractor shall submit working scale drawings of all their apparatus and equipment which in any way varies from these specifications and plans which shall be checked by the Architect/Engineer and approved before the work is started. Interference with structural conditions shall be corrected by the Contractor.

H. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.

I. Utilities: The location, size, and pressure of utility lines are shown in accordance with the data given this office by others. As Architect/Engineers, we cannot and do not guarantee the accuracy of this data. Each Bidder shall check and verify this data. The points of connection to utility lines are approximate only and shall be verified by each Bidder prior to submitting their Bid.

J. Site visit: The Contractor shall visit the site prior to bidding and satisfy themself as the conditions under which the mechanical systems are to be installed. No subsequent allowance shall be made on their behalf for failure to make such a visit. Contractor shall examine all work noted under the demolition drawings and all new work and shall satisfy themself as to the extent of work required to be completed.

1.4 SYSTEM DESCRIPTIONS

A. Not Used.

1.5 PRIOR APPROVALS

A. Each equipment item for which the Contractor desires to install equipment other than the specific item identified in the equipment schedule or equivalent equipment by manufacturers specifically named in the schedule, the Contractor shall bear full responsibility to prove to the Engineer that the furnished equipment is equivalent to or better than the specified item. Failure to provide such proof will result in rejection of the shop drawing submittal by the Engineer. Prior written or verbal approval by the Engineer of equipment by other manufacturers will not relieve the Contractor of responsibility to provide equivalence. Prior approval is required, however, any prior approval given is intended only to provide preliminary agreement that the alternate manufacturer may make equipment that complies with the specification requirements and not that all equipment manufactured by them is acceptable.

1.6 SHOP DRAWINGS

A. Shop drawings and/or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this Contract. This shall include piping, valves, fire protection equipment, plumbing equipment, control items, etc. The Contractor shall submit to the Architect/Engineer a sufficient number of copies of all such shop drawings or catalog data to provide them with as many review copies as they may need, plus three (3) copies for retention by the Architect/Engineer. No materials or equipment shall be installed until officially approved by the Architect/Engineer.

B. Before submitting Shop Drawings to the Architect/Engineer for review, the Contractor shall examine them and satisfy themself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of Shop Drawings is not intended to take the place in any way of the official review of the Architect/Engineer, and the Shop Drawings which have not been reviewed by the Architect/Engineer shall not be used in fabrication or installing any work.

C. The review of Shop Drawings or catalog data by the Architect/Engineer shall not relieve the Contractor from responsibility for deviations from the plans and Specifications unless they have, in writing, specifically called attention to such deviations as the time of submission and has obtained the permission of the Architect/Engineer thereon, nor shall it relieve them from the responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect/Engineer, they shall state in their letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

D. After receiving approval on the make and type of materials, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is done to facilitate progress on the job and failure on the part of the Contractor shall render them liable to stand the expense of any and all delays occasioned by failure on this part to provide necessary details. All shop drawings shall be delivered to the Architect/Engineer's office within thirty (30) days from the date of the contract.

E. Shop drawings will be returned unchecked unless the following information is included: installation drawings, hydraulic calculations, complete details, and all pertinent data in the Specifications or on the drawings, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.

1.7 SUBMITTALS

A. Submittal data shall be organized in commercial quality, three ring binders with durable and cleanable covers. Product information for each piece of equipment shall be separated by an indexing leaf with clear tabs. The product name and symbol (i.e., control valves) shall be typed on white paper inserts and placed in appropriate tab. Complete data must be furnished showing performance, quality, and dimensions. A signed review by the Architect/Engineer must be obtained before purchasing any equipment.

B. No review of the fire protection system shall be completed without all shop drawings, equipment, hydraulics, etc. being delivered as one package. No exceptions.

C. The following items shall be submitted for review by the Architect/Engineer but are not limited to:
   1. Utilities Piping & Materials whether furnishes by the contractor or others.
   2. Fire Protection Drawings & Hydraulic Calculations
   3. Cross Connection Control Devices
   4. Piping Material
   5. Fire Protection Equipment – including alarm valve, tamper switch, etc.
   6. Ductwork Shop Drawings – as part of fire protection drawings.

1.8 QUALITY ASSURANCE

A. General: Comply with Division 1.

B. Welder Qualifications: Welders shall be certified by the American Society of Mechanical Engineers (ASME) National Certified Pipe for the type of work being performed. Current operators' certificates in accordance with ASME standards shall be on file at the site and shall be available to the Architect/Engineer for examination. Coupons shall be available for review by the Architect and Engineer.

C. Locations of all pipes, ducts, outlets, appliances, etc., as shown on the drawings, are approximate only and are understood to be subject to such revisions as may prove necessary or desirable at the time the work is

installed. Each Contractor will be required to install their work with relation to existing building conditions and shall be entirely responsible for the correctness of their work with reference to finished elevations, etc. Piping shown on the drawings is diagrammatic only and their exact locations, depths, and invert elevations shall be as required for proper flow and coordination with other trades.

D. The contract drawing depicts graphically the arrangement of piping. Should local conditions necessitate a rearrangement, or if any of the piping or ductwork can be installed to better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit three (3) copies of Drawings of the proposed arrangement for the Architect/Engineer's review.

E. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, they shall assume full responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such change shall be accompanied by Shop Drawings of the space in question.

F. Each Contractor is responsible for the proper location and size of all slots, holes, or openings in the building structure pertaining to their work, and for the correct location of pipe sleeves.

G. Each Contractor shall coordinate their work with that of all other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines which require a stated grade for proper operation. Drainage lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

H. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Lubricate all equipment properly in accordance with manufacturer's instructions. Furnish zerk grease fittings on all greaseable bearings.

I. Equipment and Materials: The materials and equipment shall be new and shall be the standard products of the manufacturers regularly engaged in the production of Plumbing and Fire Protection Equipment, and shall be the manufacturer's latest standard design. Where two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer. However, the component parts of the systems need not be the products of the same manufacturer. Specific equipment specified hereinafter is to be considered a standard of quality and operation. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the drawings. Reference shall be made to the schedules for specific information. The capacities shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Architect/Engineer. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the plans, the manufacturer's instructions shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is to be installed.

J. Excavation and Backfilling: This Contractor shall do all necessary excavation and backfill for the installation of the Mechanical systems as may be required. Curb cuts, asphalt and concrete patching, cutting and patching existing floor, etc., shall be part of this Contractor's responsibility. No extra payment will be made for rock excavation. Trenches for all underground piping shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to ensure the pipe resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe, and before laying the pipe, the space between the bottom of the pipe and the rock surface shall be filled with gravel, thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down in the trenches and shall be filled. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. The backfill material shall be identical to the surrounding fill material and shall be placed in a 6-inch layer, wetted, and compacted to the density of the adjacent soil. See Division 2 for additional information for site utilities. All surplus materials shall be hauled from the project by the Contractor at their expense.

K. Cutting and Repairing:
   1. Responsibility of the Contractor whose work is involved. Coordinate with others to prevent unnecessary cutting and repairing.
   2. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports. Arrange with those whose work is involved to do cutting and replacing caused by negligence or error with costs reimbursed by the Contractor at fault. Cutting and replacing of existing work shall be the responsibility of the Contractor whose work is being installed.
   3. Removal or terminating connections of existing work which is abandoned or replaced shall also be done hereunder to provide correct and finished work.

L. Foundations: All equipment shall be provided with suitable foundations and supports. It shall be the responsibility of the Contractor to provide for the proper locations of these foundations and supports. This applies to all rooftop equipment also.
   1. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) the conformity with the recommendations of the manufacturer of the respective equipment, and with the approval of the Architect/Engineer. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow 1 inch below the equipment base for alignment, leveling and grouting with nonshrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed.
   2. Unless otherwise noted, foundations shall be a minimum of 6 inches high. All concrete work performed by these Contractors shall conform entirely to the requirements of the Concrete Specifications which describe this class of work.

M. Code Requirements: Comply with state and local code requirements and ordinances. Call for inspections required by responsible building inspection authority.

N. Applicable Building Codes and Ordinances: Including the latest edition of each code, but not limited to the following:
   1. International Building Code.
   2. Uniform Mechanical Code.
   3. Uniform Plumbing Code.
   4. Governing Fire Department Requirements
   5. Utility Company Requirements
   6. National Fire Protection Association Standards
   7. NFPA 70 - National Electrical Code
   8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
   9. NEPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
   10. NFPA 13 - Sprinkler Systems
   11. NFPA 101 - Life Safety
   12. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment
   13. NFPA 25 – Standard for the Inspection, Testing & Maintenance of Water Based Fire Protection System
   14. NFPA 24 – Stand for Installation of Private Fire Service Main and Their Appurtenances

O. Access Panels
   1. Similar to Milcor, or as noted on the drawings, size as required for concealed expansion joints, valving, gauges, balancing dampers, valves, traps, pitot stations, equipment and similar items requiring accessibility. Notify the General Contractor of each access panel location and the required size. Panels shall be proper type for ceiling or wall in which they are installed. The panels shall be furnished under this section of the Specifications, unless otherwise directed, but shall be coordinated to be compatible with walls and ceilings furnished under other sections.

1.9 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1.

B. Large Items: Make arrangements with other trades on the job for introduction into the building of equipment too large to pass through finished openings.

C. Acceptance: Check and sign for materials to be furnished by others for installation under Division 15 upon delivery. Contractor shall be responsible for the storage and safekeeping of such materials from time of delivery until final acceptance.

D. Protection: Close ends of pipe and ductwork at the close of each working day during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work with heavy paper or plastic until final clean-up.

E. Storage: Store equipment in covered enclosure or wrap with weather tight 6 mil Visqueen.

F. Shipping Protection: Protective casings, crating, and coverings to remain in place until start-up of equipment.

1.10 PROJECT CONDITIONS

A. Performance: All systems are to be rated at 4,000 ft. elevation.

1.11 SEQUENCING AND SCHEDULING

A. General: Comply with Division 1.

B. Schedule: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.

C. Utility Interruptions: Schedule mechanical utility interruptions with the Architect/Engineer/Owner minimum of seven (7) days prior to the requested outage. Plan work so that duration of the interruptions a maximum of one day.

1.12 CONTROLS WIRING AND ELECTRICAL EQUIPMENT

A. All fire protection equipment wiring, conduit, relays, interlocks, and all accessories required for a completely operational fire protection system shall be the complete responsibility of the fire protection contractor. The fire protection contractor has the option to hire the project electrical contractor to install wiring and conduit. Refer to Specification Sections and 25 09 00 and 25 30 00 for coordination requirements between mechanical, electrical, and controls subcontractors.

B. Electrical items such as disconnect switches and motor starters associated with equipment provided by all Mechanical Divisions, when specifically mentioned to be furnished by the Mechanical Contractor, whether in these specifications or on the Electrical or Mechanical Drawings, shall be furnished by the Contractor. These items shall be mounted and connected as required for a completely operational system. See Control Systems Specification for further information.

C. All electrical equipment characteristics (voltage, etc.) must be verified by the Contractor prior to ordering. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, they shall first inform the Architect/Engineer of the change and shall then coordinate the change with the Electrical Contractor and shall pay all additional charges in connection with the change.

D. All motors shall meet all the requirements of all Electrical Divisions.
   1. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general-purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. All motors shall have copper windings. All motors to have minimum power factor of 85% or have switched correction to 90%. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 40°C rise and total temperature rise of 65°C ambient and when powered from the system voltage feeding the motor. TEFC motors shall a service factor of 1.00 with total temperature is of 65°C in the above conditions. Motors located in areas exceeding 40°C ambient shall be factory-rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Type N split phase induction motors with built-in thermal protectors. Single phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors. Single phase motors of 1/10 HP or less may be shaded pole induction motors.

1.13 PROTECTION AGAINST HAZARDOUS CONDITIONS

A. The Contractor shall take precautions against hazardous construction conditions at all times during construction. The final condition of the facilities shall be safe, and where safety to operating personnel is jeopardized, suitable signage shall be posted.

B. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operating personnel, shall be cut back and/or protected to reduce the risk of injury. All openings between floors shall be protected with barriers around the openings, gratings across the openings, or steel bars through the openings to avoid and protect against injury.

1.14 HAZARDOUS SIGNS

A. Equipment room contains moving or rotating parts, floor openings, or other potentially hazardous environments and shall include a sign on the door entering it that shall read similar to the following: **Hazardous Area - Authorized Personnel Only.**

1.15 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Mechanical Contractor shall furnish to the Owner a bound manual in triplicate, containing complete repair parts lists, and operating, service, and maintenance instructions on all mechanical equipment, fixtures, and systems.

B. The Mechanical Contractor shall also provide training as required by Section 230100 to the Owner's operation and maintenance personnel.

1.16 OPERATION PRIOR TO ACCEPTANCE

A. The Owner shall have the right to operate any and all apparatus as soon as and as long as it is in operating condition, after Owner personnel have received operational training, whether or not such apparatus has been accepted as complete and satisfactory, except that this shall not be construed to mean operations before any required alterations or repairs have been made. This operation does not indicate acceptance of the equipment by the Owner. When the Contractor enters into a contract with the Owner, they agree to the above.

1.17 WARRANTY AND SERVICE PROGRAM

A. Due to the critical performance requirements and to clearly establish warranty responsibility for this project, the Contractor shall provide a full-service maintenance and warranty program to the Owner for one full year after beneficial occupancy (substantial completion).

B. This service program shall be included as part of the base bid and shall include service, maintenance, repair, replacement, lubrication, temperature control calibration and repairs, and documenting proof for all service and maintenance work on all equipment and system furnished by the Contractor.

C. A single representative in the employment of the Contractor shall be responsible for coordination and follow through of this program. This representative's name and phone number shall be submitted to the Owner as part of the maintenance manuals and supportive data. The Contractor shall respond to a request for service with 24 hours if so requested.

1.18 GUARANTEE

A. The Contractor shall guarantee all materials, equipment, and workmanship furnished and installed by them under this Contract, to be free from all defects of workmanship and materials, and shall agree to replace at their expense, without expense to the Owner, at any time within one year after installation is accepted by the Architect/Engineer, any and all defective equipment, parts, etc., that may be found. (This excludes normal maintenance and daily servicing of equipment which is the Owner's responsibility.)

1.19 FLOOR, WALL, AND CEILING PLATES

A. Where exposed pipes pass through floors, finished walls, or finished ceiling, they shall be fitted with chromium-plated escutcheons of an approved pattern. Escutcheons and plates in Mechanical Rooms do not require chrome finish.

B. This Contractor shall be responsible for providing and installing all counter flashing. All openings in the roof shall be flashed and counterflashed. Use four-pound lead flashing materials for all vent lines and welded flashing in steel lines passing through roof. The Mechanical Contractor shall notify the General Contractor where each roof penetration is and the size of the opening.

1.20 PIPE SLEEVES

A. Schedule 40 steel pipe sleeves or pipe sleeves made of No. 20 gauge galvanized steel, properly secured in place with approximately 1/4" space between each sleeve and the surface of the pipe and/or insulation passing through it, shall be provided for all pipes passing through concrete floors, roofs, and masonry walls. All pipe sleeves shall be fixed in place as the walls and floors are built up. The Contractor shall furnish and locate all sleeves and pipes passing through concrete floors, exterior masonry walls, and roofs shall be made watertight with approved non-hardening plastic material. Sleeves through pipe chase or equipment room floors shall project a minimum of 2 inches above the floor and shall be of black steel pipe with waterproof flange at center of floor thickness. Each sleeve through a fireproof wall shall be packed with approved fireproof rope in the annular space.

1.21 PIPE HANGERS

A. Pipe hangers shall be Fee and Mason of a type suitable for each use. Perforated straps shall not be used in any work. For ferrous pipes up to and including 4 inch in size, use Fee and Mason Fig. 199 malleable iron, adjustable, split ring, swivel hanger. For plumbing piping larger than 4 inches, use Fee and Mason Fig 239 steel clevis hanger. Where several pipes are parallel at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where indicated on the Drawings. For copper pipes up to and including 3 inch in size, use Fee and Mason Fig. 360 malleable iron, copper plated hangers. For copper pipes larger than 3 inches, use Fee and Mason Fig. 364 copper plated clevis hanger.

B. Hanger rod sizes shall conform to the following schedule:

1.	Pipe up to and including 2"	3/8" rods
2.	Pipe 2-1/2", 3" and 3-1/2"	1/2" rods
3.	Pipe 4" and 5"	5/8" rods
4.	Pipe 6"	3/4" rods
5.	Pipe 8”, 10”, and 12”	7/8” rods

C. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following spacing:

1.	Pipe up to and including 1-1/4"	8'
2.	Pipe 1-1/2" and 2"	10'
3.	Pipe 2-1/2" and 3"	12'
4.	Pipe 3 1/2” and 4”	14’
5.	Pipe 5” and 6”	16’
6.	Pipe 8” and 10”	20’

D. Unless shown otherwise on the Plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction as the case may be, by means of hangers with the following maximum spacing:

1.	Pipe up to 3/4" in size	5'
2.	Pipe 1" and 1-1/4"	6'
3.	Pipe 1-1/2" and larger	10'

E. There shall be a hanger within 2 inches of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length of pipe. Vertical risers shall be supported by approved riser clamps at each floor. Vertical pipes within a space shall have not less than two supports.

F. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting, nor shall it be supported from equipment connection.

G. Expansion bolts shall be Ackerman-Johnson or Hilti.

H. Beam clamps suitable for use with this type of steel construction involved shall be Grinnell.

1.22 PRESSURE VESSEL CERTIFICATION

A. Not used.

1.23 ISOLATION

A. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical Contract will be extremely objectionable and the Contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them, and consequently, they shall design all foundations, supports, etc., for their equipment, and all piping with this end in view. In addition, these Contractors shall supervise the construction of all foundations and supports, whether they build them or not, in order that they may be constructed in such a manner as to prevent the transmission of objectionable noise and/or excessive vibration. Submit calculations on all vibration isolation equipment.

B. All equipment having moving parts shall be isolated from the building structure by means of Korfund isolation materials, unless specifically noted otherwise. All isolators shall be the same brand and shall be supplied

from the same source. Equipment manufacturer's recommendations shall be followed in the isolation of equipment.

C. Vibration isolators shall have sufficient resilience to meet the following minimum efficiencies:

Motor HP	Equipment Room
Up to 5	90%
7-1/2 to 15	93%
20 to 40	95%
50 to 100	97.5%

D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the baseplate, or may be unhoused stable springs. Isolators shall be furnished with snubbers and limit stops where so recommended by the equipment manufacturer.

E. The Supplier of the isolating equipment shall, upon completion of the job, check all isolating materials and verify that they are installed properly, and submit a report in writing to the Architect/Engineer.

1.24 TESTING

A. Before completion of this project, the Contractor shall test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the Specification requirements, whichever is more stringent.

B. All equipment shall be operated sufficiently long enough to prove to the Architect/Engineer that the equipment performs satisfactorily and meets the requirements set forth on the Plans or in these Specifications.

1.25 CERTIFICATIONS

A. Before receiving final payment, the contractor shall verify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications. Submit certifications and acceptable certificates to the Architect/Engineer.

1.26 GENERAL PIPING INSTALLATION REQUIREMENTS

A. Provisions for Drainage: All piping systems shall be installed so that they may be easily drained. Drain caps, plugs, or hose bibbs shall be installed at low points. Grade piping toward drain locations.

B. Alignment: All installed pipelines shall be straight and shall remain straight against strains. Proper allowance shall be made for expansion and contraction.

C. Clean as Installed: All piping shall be kept free from scale or loose dirt when installed, and must be kept clean during the completion of the installation. All openings in the piping system shall be capped or plugged while awaiting further connections. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the system in which they are used. They shall not adversely affect the materials of mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents, and other cleaning agents shall also be compatible with the process streams to be handled by the systems in which they are used.

D. Insulated Fittings: Install between any dissimilar metals such as steel and copper.

E. Expansion and Contraction: The Contractor shall make all necessary provisions for expansion and contraction with proper fittings, anchors, dresser couplings, loops, etc. Install flexible connectors on each pipe at each building expansion joint.

F. Welding: Refer to Paragraph 1.27 of this section of these specifications.

G. Bending: No bending of pipe will be permitted.

H. General: The installation shall be coordinated with respect to space available with heating, cooling, ventilating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows, shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly

clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping, installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings or as recommended by the equipment manufacturer. Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work, and not less than 1/2 inch between finished covering on the different services.

I. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified and where directed at site. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.

J. All valves which must be used during operation, all control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation shall be located conveniently accessible from an operating platform or grade.

K. In general, relief valves within processing unit limits shall be located conveniently accessible from an operating platform or grade.
   1. Those in non-hazardous service, such as water, shall discharge directly to outside.
   2. Relief valves should have no piping between the vessel or line and the valve inlet, except as shown on the drawings.
   3. Relief valves shall be installed in a vertical position. Vent piping shall be braced and supported in a manner that will not produce excessive stresses in the relief valve and will permit removal of the relief valve without necessary temporary supports for the vent lines.

L. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings. Provide removable headers for large equipment for service access.

M. Joints
   1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be turned off. All flanged bolt holes shall straddle the horizontal and vertical center line unless otherwise noted.
   2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1 Latest Edition. Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.
   3. Solder-Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool or wire brush before seating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for serrated fittings on water, compressed air below 60 psig, and vacuum lines shall be made with a 95 percent tin and 5 percent antimony. Cored solder or solder containing lead will not be permitted.

N. Reducers: Reduction in pipe size shall be made with one piece reducing fittings. Bushings reducing at least two pipe sizes will be acceptable only when there is no room for reducing couplings or swaged nipples.

O. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union Pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.

1.27 WELDING

A. All welding of piping covered by this specification, regardless of condition of service shall be accompanied as follows:
   1. The welding shall be in accordance with the recommendations of the American Welding Society. Mitering of pipe to form elbows, notching to form these, or any similar construction will not be permitted. Welding fittings shall be installed on all welded lines. Joints to be welded shall be properly aligned and spaced, using special welding clamps where necessary. All welders to be employed shall have passed qualification tests prescribed by the National Certified Pipe Welding bureau (or by another reputable

testing laboratory or agency) using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The welders will be required to pass qualification tests when the work of the welder creates a reasonable doubt as to their proficiency. Tests shall be conducted at no additional expense to the Owner.

2. Each welder shall, in addition to having passed the prescribed qualification tests (as noted in Paragraph 1.27.A.1), prepare sample coupons at the job site on a portion of pipe that is cut such that the cross section of the weld is open to view. The sample weld should be prepared using a 6-inch diameter pipe. The sample shall reflect a continuous weld with perpendicular cut out to show the weld in cross sectional view. This sample, when accepted and approved by a certified welding inspector, shall be used as a standard of quality to compare to other welds that this welder will be performing on the job. This same sample weld will also be a basis for accepting or rejecting the welder for working on this project. The sample weld shall be identified with a date and the welder's name and shall be kept at the site throughout the project.
3. All welding on pressure piping shall conform to all of the requirements of the American Society of Mechanical Engineers Code for Pressure Piping - B31.1 (An American National Standards Institute publication), as defined in the latest edition of the ANSI Power Piping B31.1 Manual. All welding shall also conform to all of the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. All chapters, current addenda and supplements of these manuals shall apply. This code shall be used to establish standards of performance and quality of welds. However, the Owner reserves the right to perform radiographic testing of all welds, to compare any of the welds to the approved "standard" sample welds of each welder, and to compare the welds to the welding diagrams and sketches of those recommended in the ANSI B31.1 Power Piping Manual. The intent is to obtain the highest quality welding job possible. The cost of any initial radiographic testing, for random inspection, shall be paid for by the Owner. If radiographic random testing reveals that a weld is defective, the Contractor shall bear the cost of all repairs and re-testing necessary to be made to subject weld until conformance with radiographic tests is reached. The potential for random radiographic testing and welding quality control applies to all pressure piping systems in this project, including systems below 100 psig. If a question should arise regarding the possibility of faulty welding or if there are obvious visual defects in the welding, the Contractor shall be required to correct such deficiencies to a quality level consistent with the recommendations, welding diagrams and sketches in the ANSI B31.1 Manual. The quality level shall also reflect that of the approved sample welds accomplished by each welder for this particular project.

1.28 TESTING FOR PIPING SYSTEMS

A. General: Before insulation is applied, all piping, equipment, and accessories installed under this contract shall be inspected and tested by the Contractor. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying tests. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with water (liquid lines only) at a sufficient flow rate and period of time, to ensure complete cleaning of the lines of all dirt, scale, and foreign matter. Satisfactory flushing of the lines shall be subject to approval. After testing and flushing lines, all filters and strainers shall be cleaned.

B. Safety: Since the Risk of failure, with the attendant possibility of injury, is appreciable greater with further testing, all safety measures required by codes or ordinance or reasonable applicable to the situation shall be taken.

C. Concealment: Equipment or piping to be pressure tested shall not be insulated, covered, or concealed prior to that test. Compression joint underground piping may be backfilled prior to pressure test except that joints shall remain exposed until after the test, but tie rods, clamps, etc., shall be in place and fastened.

D. Pressure Ratings: These tests shall not be used to establish pressure ratings.

E. System Protection: Protect all piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during the filling, testing, and draining procedures. Seats of iron valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Pressure tests against other closed valves shall not exceed twice the normal rating. Note that where significant differences in elevation exists, there is a risk of overpressure in the lower portions of the system in order to attain test pressure in the upper portion of the system

F. Sectionalizing: Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.

G. Temporary Supports: During hydrostatic testing of lines provide temporary supports to prevent overstressing supports or hangers. When tests are completed, remove all temporary supports, locks, stops, etc., and adjust supports for their cold load and alignment.

H. Testing: Fire protection water piping shall be tested hydrostatically at the test pressures specified and duration required by NFPA. Leaks shall be located by soap testing.

I. Test Report
   1. A detailed report of pressure tests on piping and equipment shall be forwarded in duplicate to the Architect/Engineer. This report shall show date of test, lines tested, test medium, length of time test pressure was held, pressure drop or rise, and extent of venting or repressurizing.

1.29 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other sections of these specifications covering the work of other trades which must be carried out in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay, or absence of coordination.

1.30 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions covering the mechanical work at the building. No extra compensation shall be claimed or allowed on account of difference between actual dimensions and those indicated on the drawings. They shall examine the adjoining work on which Mechanical work is dependent for maximum efficiency, and shall report any work which must be corrected. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting Mechanical work.

1.31 SAFETY GUARDS

A. The Fire Protection Contractor shall furnish and install safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded. Provide coupling guards on all rotating shafts.

1.32 PROTECTION

A. All work, equipment, and materials shall be protected at all times to prevent obstruction, damage, or breakage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected against dirt, water, chemical, or mechanical injury. At the completion of the work, all equipment shall be thoroughly cleaned and the entire system shall be delivered in a perfect, unblemished condition.

1.33 PAINTING AND IDENTIFICATION

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance.

B. Except as elsewhere hereinafter specifically required, any painting of equipment, piping, ductwork, grilles, insulation, etc., furnished and installed under this Section of the Specifications will be done by the Painting Contractor. However, the Mechanical Contractor shall leave their equipment clean and free from any grease, dirt, rust, etc., and in suitable condition for painting.

C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.

D. The piping shall be painted the basic color as indicated in other sections of these specifications and shall be marked every 10 feet on centers with Brady pipe markers. Arrows, approximately 6 inches in length and spaced about 10 feet on centers shall indicate the direction of the flow pipe. Locate additional labels as required in Mechanical Rooms. Staple in place, brush with clear lacquer. Markers shall state pipe size, flow direction, and pipe usage (such as "cold water," etc.).

1.34 RECORD DRAWINGS

A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all dimensional locations of equipment piping and all deviations and/or changes in the work shall be recorded. Water, storm, and drainage mains shall be delivered to the Architect/Engineer in good condition upon the completion and acceptance of the work and before final payment is made.

1.35 SUPPLIER RESPONSIBILITY

A. Each supplier, whether furnishing equipment as specified or as a substitution shall be responsible for certifying that the equipment is properly installed and that the warranty is valid. Submit written reports on the installation and the equipment performance when requested to do so by the Architect/Engineer (or their representative). Each supplier shall be responsible for furnishing qualified personnel at the job site at any time requested by the Architect/Engineer (or their representative) during the construction or warranty periods.

END OF SECTION

SECTION 21 13 00 AUTOMATIC SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This specification, in conjunction with the contract drawings and all other specifications indicate materials and operations required for the installation of automatic sprinkler systems, including design, shop drawings, equipment, underground supply system, pipe and fittings above ground, fire department connections, sprinkler systems, guard rail, operating instructions, identification, tests, and sterilization of piping and system.

B. Any variation of the specification's intent or apparent conflict from this specification shall be submitted to the ARCHITECT/ENGINEER for written response. The response shall be incorporated into the drawings and shall be the final word on the item. The Contractor shall incorporate any change at no charge to the Owner.

1.2 REFERENCES

A. This specification section is not limited to the following specification:

21 05 00 GENERAL FIRE SUPPRESSION REQUIREMENTS
22 10 00 PIPE AND PIPE FITTINGS

B. The current editions of the following standards are a part of this specification.
1. National Fire Protection Association (NFPA) Standards.
   a. 13 Standard for the Installation of Sprinkler Systems.
   b. 14 Standard for the Installation of Standpipes and Hose Systems.
   c. 24 Private Fire Service Mains.
   d. 70 National Electrical Code.
   e. 72 National Fire Alarm Code.
   f. 25 Standard for Inspection, Testing and Maintenance of Water Based Fire Protection Systems.
2. American Water Works Association Standard Specifications.
   a. C600 Standard for the Installation of Ductile-Iron Water Mains and Their Appurtenances.
   b. C150 Ductile-Iron Pipe
   c. C110 Ductile-Iron and Gray Iron Fittings.
   d. C111 Rubber Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.
   e. C151 Ductile Iron Pipe Centrifugally Cast for Water
   f. C104 Cement-Mortar Lining for Ductile-Iron and Gray Iron Pipe and Fittings.
   g. C500 Metal Seated Gate Valves for Water Supply Service.
   h. C601 Standard for Disinfecting Water Mains.

C. Underwriters' Laboratories, Inc. (UL), Publication: Fire Protection Equipment List.

D. Factory Mutual System Publication: Approval Guide.

E. American Insurance Association Publication: Internal cleaning of sprinkler piping (GP-4).

1.3 SYSTEM DESCRIPTION

A. Design
1. The designer of the fire protection systems shall meet one of the requirements below.
   a. A registered Professional Fire Protection Engineer in the State of New Mexico.
2. The contractor is responsible for the design and installation of the fire protection system in accordance with these specifications and the contract drawings. The Contractor shall coordinate with architectural, civil, mechanical, and electrical, design and construction documents, to ascertain the required information, to affect a properly designed fire protection system for the building construction and occupancy classification.
   a. The contractor is responsible to design the automatic sprinkler system in accordance with these specifications and the contract drawings. The contractor shall refer to all architectural, mechanical, and electrical drawings, to ascertain the required information, to affect a properly designed sprinkler system for the building construction and occupancy classification.
3. The design of fire protection systems shall be complete with all necessary accessories for proper operation and shall include seismic support details.

4. The fire protection water supply lines, controlling devices, protective devices, alarm systems, supervisory devices, and related equipment shall be compatible so that all equipment will function together as specified.
5. The design shall comply with all mandatory, advisory interpretations, and recommended applicable rules of the latest editions of the referenced codes and standards in Section 1.3, “References,” except where otherwise noted on the drawings or specified herein.
6. The Contractor shall produce design drawings that indicate the extent and arrangement of the fire protection system.
7. The contract drawings indicate the extent and general arrangement of the automatic sprinkler systems.

B. Spacing and Pipe Sizing
1. Unless otherwise specified or shown on the drawings, the sprinkler system shall be a wet pipe system, utilizing a Light Hazard hydraulic design.
2. Hydraulically system shall be designed on the contract drawings having the following characteristics:
   a. The design area shall be the hydraulically most demanding "rectangular area" having a dimension parallel to the branch lines equal to 1.4 times the square root of the area of sprinkler operation.
   b. Where the design area includes a corridor or tunnel protected by a single row of sprinklers, the maximum number of sprinklers that need be calculated is 10, unless openings into the corridor are unprotected by fire rated construction.
   c. Maximum water flow velocity shall not exceed 20 feet per second in any sprinkler system piping of hydraulically designed systems.
   d. The hose allowance shall be added to the sprinkler requirement at the point(s) where the hose station(s) connect(s) to the sprinkler system. The selected hose station(s) shall be within or nearest to the area of sprinkler application.
   e. Hydraulic design shall be based upon the water supply data shown on the drawings or obtained from the local Municipal Water Department.
   f. Hydraulic calculation methods shall be used as a minimum for Light Hazard, wet-pipe systems, unless otherwise specified. The minimum operating area allowed shall be either 1500 feet^2 or the entire area for smaller systems. No allowances or reductions shall be permitted without written approval from the ARCHITECT/ENGINEER.
   g. Extend all hydraulic calculations back to the effective point of connection (ring-main) of the sprinkler lead-in to the fire water main supplying the building, unless indicated on the contract drawings.
   h. The distance between sprinklers either on branch lines or between branch lines shall not be less than 6 feet distance apart.

C. Seismic Protection
1. Seismic protection for automatic sprinkler systems is required for all systems.
   a. Seismic separation joints are required in areas separating the modified area of the sprinkler system and that area which is not to be upgraded for seismic protection.
   b. The installation guidelines for seismic protection in NFPA 13 shall be used. Where an alternative method (other than NFPA 13) of providing seismic protection of a sprinkler system is to be used, only UL Listed or FM Approved material shall be permitted. The alternative method shall have a design based on a dynamic seismic analysis certified by a registered Professional Engineer in the State of New Mexico and the registered PE shall stamp all drawings.

D. Standpipes
1. Standpipes, where shown on the drawings, shall be installed as Class I system per NFPA 14. Hydraulic calculations are required for all wet standpipes serving two or more hose stations.

E. Protection of Areas Subject to Freezing
1. All anti-freeze systems require the installation of a reduced pressure backflow prevention (RPBFP) device. If a RPBFP is installed on the entire sprinkler system, then no additional RPBFP is required for the anti-freeze system.
2. Gridded or looped dry pipe or preaction systems are not allowed. The design for these systems shall be of the conventional tree design.
3. All dry-pipe systems, regardless of the volume, are required to deliver sustained waterflow to the inspector’s test connection within 60 seconds of the opening of the inspector’s test valve. All dry pipe systems in excess of 500 gallons shall be provided with a UL listed or FM approved quick opening device, exceptions to NFPA 13 in this instance do not apply.

F. Manifolding of sprinkler risers to one single sprinkler lead-in shall not be permitted.

G. Fire Department connections shall be as follows:
1. Install Fire Department connections, where shown on the drawings.
2. When the sprinkler system hydraulic demand (not including exterior hose demand) exceeds 1000 gpm, a 6” 3-way Fire Department connection shall be provided.

3. A single fire department connection shall be provided to supply all fire protection systems for a building that has greater than 5 sprinkler risers.

H. Elevator Shafts and Machine Rooms
1. Sprinklers are required at the tops of all elevator shafts and in the elevator equipment rooms. Sprinklers shall be protected from freezing.
2. Provide an OS&Y gate valve to shut off all sprinkler water flow into the elevator shaft and into the elevator machine room. Where possible, piping should be arranged such that a single valve can shut off water to both locations.
3. The valve(s) shall be at a readily accessible location, no more than 7’0” above finished floor, inside a clearly marked wall cabinet.

1.4 SUBMITTALS

A. Shop Drawing Submittals
1. Provide as required by Division 1, Descriptive Submittals, to the Architect/Engineer.
2. As soon as practicable after award of contract and prior to fabrication, contractor shall submit to the Architect/Engineer for approval, complete shop drawings, manufacturers' catalog data, system and component operating instructions and hydraulic calculations for the sprinkler system and underground piping shown on plot plans.
3. NO INSTALLATION WILL BE PERMITTED prior to the Architect/Engineer approval of complete shop drawings.

B. Presentation:
1. New Sprinkler Systems
a. New drawings shall be identical in size, scale, orientation, and title as the original building construction contract drawings unless otherwise noted.

C. Drawing Details
1. Unless otherwise specified or shown on drawings, new floor plans and full height cross sections shall be drawn at a scale of 1/4" = 1'-0" and arranged such that the north arrow points to the top or to the left of the sheet. Other details shall be drawn to a larger scale, as required. Riser elevation details shall be drawn to a scale of 1/2" = 1'-0"
2. No more than one building or one floor shall be shown on a sheet.
3. Drawings shall show all details required and recommended by NFPA 13, for "Working Plans" in addition to the following:
a. A name or room number shall appear in each room; and a scaled key plan, oriented the same as the floor plan, shall appear on each partial plan sheet.
b. All obstructions to the sprinkler layout shall be shown, including but not limited to, HVAC ducts, lighting, electrical buss ducts.
c. Building column lines shall be labeled.
d. Existing work and new construction shall be clearly differentiated on the drawings (where applicable).
e. All lines and details shall be drawn; "opposite hand" or mirror image IS NOT acceptable -- separate drawings shall be made.
f. All pipe lengths shall be shown, center-to-center of fittings.
g. Where more than one type of pipe is used, each piece of pipe shall be identified as to type on the drawings.
h. The drawings shall be kept neat and well arranged, with legible notes and figures to permit photographic reduction to one half size or smaller.
i. No lettering shall be smaller than 1/8”.

D. Plot Plans
1. Plot plans shall be drawn to 1" = 20'-0" unless otherwise shown on the contract drawings.
2. Previous references to orientation, legibility, and lettering shall apply.
3. Plot plans shall show all details required by NFPA 13 and 24.

E. As-Built Drawings
1. Upon completion of the work, the Contractor shall revise all drawings to agree with the construction as actually accomplished. The notation "As-Built" shall be entered in the revision block, dated, and initialed.
2. The As-Built drawings shall show the entire sprinkler system as it existed at the completion of the contract work.
3. The original As-Built drawings shall be delivered as directed by the ARCHITECT/ENGINEER.

1.5 ALTERNATES/ALTERNATIVES

A. Where specific manufacturers or model numbers are mentioned in these specifications, proposed substitutions shall be included in the submittal package furnished to the Architect/Engineer for approval after contract award.

B. If UL-listed or FM-approved equipment is commercially available, none other will be approved.

1.6 WARRANTY

A. All sprinkler system components furnished under this contract shall be guaranteed against defective design, materials, and workmanship for the full warranty time, which is standard with the manufacturer and/or supplier, but in no case less than one year from the date of system acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Materials and equipment used in the installation of the sprinkler system shall be new and listed by the UL Fire Protection Equipment Directory or the FM Approval Guide, latest edition. The standard products and the latest design of the manufacturer shall be used, and installed per their listing, approval, or manufacturer recommendations. All products listed or approved by prior editions of the UL Director of FM Approval Guide will not be acceptable, if not listed or approved in the most recent edition of the directory or approval guide.

B. Where two or more units of the same class of equipment are required, these units shall be products of the same manufacturer (e.g., couplings shall be from one manufacturer.) All materials shall be installed per their listing or approval and per the manufacturer's recommendations and specifications.

C. Tape for screwed joints shall be minimum 1/2" wide.

D. Corrosion protection tape shall be Scotchwrap 51, manufactured by 3M Company or approved equivalent.

2.2 SPRINKLERS

A. Types
1. Unless otherwise specified, allowed per other section of this document, or shown on the drawings, sprinklers shall be nominal, 1/2" orifice, automatic, closed-head sprinklers rated at 155ºF (68ºC) Quick Response, frangible bulb type fusible element.
2. Higher temperature rated sprinklers shall be installed where heads are exposed to high ambient temperature, exposed to the direct rays of the sun, beneath skylights or windows and installed in the vicinity of heating equipment, or in attics. The sprinkler temperature chosen shall be a minimum of 50ºF above the maximum ambient temperature, and no greater than 100ºF above the ambient conditions, unless specifically directed by NFPA 13.
3. Rooms containing electrical equipment shall be protected with sprinklers having the following minimum temperature ratings, but no less than 50ºF above normal ambient room temperature:
   a. Transformer and Switchgear rooms; Elevator machine rooms — 212ºF (100ºC)
   b. Computer rooms — 155ºF (68ºC) QR
   c. Telephone equipment rooms — 155ºF (68ºC) QR
   d. Top of elevator shafts — 212ºF (100ºC)
4. On-Off sprinklers are not allowed. FM approved or UL listed on-off sprinkler systems, like the Viking FireCycle (or approved equal), are allowed.
5. Quick Response (QR) sprinklers, where specified on the drawings, shall have a Response Time Index (RTI) of 50 or less in English units and 28 or less in metric units.
6. Sidewall sprinklers shall be Underwriters' Laboratories listed or Factory Mutual approved for Ordinary Hazard Occupancy.
7. Extended coverage sprinklers are not allowed.
8. Only sprinklers with a "Belleville" type seal shall be used. No O-Ring sealed sprinklers shall be allowed either in "crush" seals or "radial" seal styles. Sprinklers shall be of all brass frame construction with a coated metal to metal seating mechanism.
9. Only sprinklers with integral shields listed by UL as "intermediate level" sprinklers or by FM as "racked storage" sprinklers are acceptable indoor where shield are required over ordinary sprinklers. Shop-made water shields are not allowed, nor are after market attachments designed as water shields. "Heat collection devices" for use with sprinklers shall not be allowed.

10. Sprinklers installed in storage racks shall be equipped with a listed sprinkler head guard with an integral water shield to protect the in-rack sprinklers fusible element from water spray by a sprinkler above it. Roof sprinklers subject to mechanical damage shall be equipped with a listed sprinkler head guard.

B. Protection Against Freezing
1. Horizontal dry sidewall sprinklers shall be used in lieu of antifreeze loops for narrow unheated areas adjacent to heated areas, such as docks, covered loading platforms, vehicular air locks, elevator hoistways, and gas bottle or other storage sheds.
2. The depth of the protected space shall not exceed 10 feet.
3. The dry sprinkler shall extend a minimum of 12 inches into the heated space. For refrigerated spaces, the length dry sprinklers shall extend into the heated space shall be as specified by the Architect/Engineer.

C. Position and Finish
1. Sprinklers installed on exposed piping shall be manufacturer's standard finish pendent sprinklers. Sprinklers and escutcheons installed below dropped ceilings shall have a finish matching the color of the ceiling tile. Only factory applied finishes shall be acceptable. If the factory has a finish that cannot match the ceiling tile color, standard finish sprinklers are allowed.
2. In rooms where sprinkler heads penetrate a suspended ceiling, only quick response, semi-recessed or recessed sprinklers are acceptable. Standard pendant sprinklers with "cup and skirt" escutcheons, one-piece escutcheons, or flush or concealed sprinklers are not allowed.
3. Escutcheons, head guards, and water shield from the supplied sprinkler manufacturer shall be used solely with the installed sprinkler. No after market escutcheons, head guards, or water shields are allowed.
4. Head guards shall be two-piece, universal attachments, bolted in place on the sprinkler. "Snap-on" one-piece units are not allowed.

2.3 PIPE

A. Exterior Water Distribution
1. Ductile Iron: Piping below floor to flange above floor from 5 feet outside building. ANSI C150 A21.51, minimum working pressure 200 psi. Cement mortar lined per ANSI A21.4. Mechanical joint fitting per AWWA C110 or push-on fittings per AWWA C110 and ANSI A21.11. Fittings shall be cement lined per ANSI 21.4, standard thickness.
2. Polyvinylchloride (PVC) PLASTIC: Pipe, couplings and fittings conforming to ASTM D1784, Class 12454, product standard AWWA/ASNI C900 to outside building.
   a. Pipe 4" through 12" size. Pipe, couplings, and fittings shall conform to AWWA C900, class DR18, CI pipe dimensions only, elastomeric gasket joints. Gaskets per ASTM F477.

B. Pipe for installation above ground shall be metal conforming to the requirements of NFPA 13. No plastic pipe is permitted in any location whether or not permitted by NFPA. Pipe shall be listed by UL and be FM approved, and installed per its listing and approval and meet the following requirements:
1. Mechanical rolled groove pipe or cut groove pipe shall not be used at fire protection risers or for segmented arcs. Use swing jolt at locations of segmented arcs.
2. Unless otherwise specified, the minimum steel pipe wall thickness shall be Schedule 10 for pipe sizes 3 inches or larger. Pipe sizes smaller than 3 inches shall be Schedule 40. Threaded or cut groove steel pipe shall be Schedule 40 for sizes less than 8 inches and a minimum of Schedule 30 in sizes 8 inches and larger for pressures up to 300 psi.
3. Mechanical rolled groove pipe or welded pipe shall be a minimum of Schedule 10 for sizes 3 inches up to 5 inches, 0.134" wall thickness for 6 inches, and 0.188" wall thickness for 8"and 10" pipe for pressures up to 300-psi.
4. Steel pipe, installed for the water motor alarm line, piping from drain line valves and inspector's test valves, dry pipe and preaction sprinkler system piping, and where pipe is exposed to outdoor weather, etc., shall be internally and externally galvanized. Galvanized fittings are required where galvanized piping is used. Any piping leading to a pressure-operated waterflow indication device shall also be galvanized. The starting point is on the alarm connection to the alarm check valve.

C. Mechanical rolled groove pipe or cut groove pipe shall not be used at fire protection risers or for segmented arcs. Use swing jolt at locations of segmented arcs.

D. Braided stainless steel (or other materials) flexible sprinkler drop shall not be used to install sprinklers.

2.4 THRUST BLOCKS

A. All underground water line tees, crosses, bends, and valves shall be provided with concrete blocking. Concrete blocking shall be used for cast-iron or vitrified clay tile fittings where a change of flow direction

occurs. All fittings at bends in the pipeline shall be firmly wedged against the vertical face of the trench by means of concrete thrust blocks bearing on undisturbed earth, to prevent the fittings from being blown off the line when under pressure. Fittings at vertical bends downward shall be anchored with concrete anchors as required. Thrust blocks shall be determined using an allowable soil bearing pressure of 1,500 PSF at 200 psi test pressure in water line. No blocking will be covered or backfilled until inspected and approved by the Architect/Engineer.

B. Mechanically restrained joints shall be permitted in accordance with manufacturer's detail and recommendations.

2.5 PIPE FITTINGS

A. Pipe fittings for installation above ground shall conform to the requirements of NFPA 13 and shall be FM approved or UL listed.
   1. Mechanical groove couplings are required on all 4 inches and larger pipe.
   2. Plain-end pipe couplings shall not be used in any new installation.
   3. Galvanized pipefittings shall be installed where galvanized piping is specified.
   4. Welded branch outlet fittings (weld-o-lets, groove-o-lets, etc) shall be minimum Schedule 10 for pipe sizes 3 inches or larger. Pipe sizes smaller than 3 inches shall be Schedule 40 standard wall pipe thickness. Welded outlets shall be UL listed or FM approved, affixed with the UL or FM identification stamps, and pressure rated for 300-PSI maximum.
   5. Adjustable, two-piece drop nipples shall not be used. All drop nipples shall be one-piece, non-adjustable units with a minimum 1" diameter.

2.6 PIPE HANGERS, SUPPORTS AND SEISMIC BRACING

A. Pipe hangers, and hangar assemblies shall be UL listed of FM approved.

B. C-clamps and beam clamps shall have lock nuts and retaining straps, or clips, and pipe rings shall be of the solid-band adjustable swivel type.

C. Provide rod-ceiling plates at finished ceilings for coach screw rods, expansion shields, and toggle hangers.

D. All seismic bracing devices and flexible couplings shall be specifically UL listed or FM approved and installed per their listing or approval.

E. When fastening hangars to purlins, bolt-through fastening methods shall be used. Beam clamps with restraining straps shall not be used in any circumstance.

F. All seismic brace members shall be continuous. Under no circumstances shall members be spliced or offset.

G. The use of "Sammy" hangers shall not be used through "B-Deck" at the roof level. "Sammy" screws may be used in other locations as appropriate to manufacturer installations requirements and details.

H. Tension-only seismic bracing systems shall meet the following.
   1. The tension-only system shall be UL or FM approved for seismic service, and installed in accordance with listing limitations and installation instructions.
   2. A means to prevent vertical motion due to seismic forces shall be installed at the brace location.
   3. Two tension only braces shall be installed in opposing directions at each brace location.

2.7 FIRE PROTECTION CHECK VALVES

A. Check valves in sprinkler system shall be UL listed or FM approved, have hand hole covers to provide adequate access to facilitate inspection and repair, without the removal of the valve from the system, and shall be listed for installation in the vertical or horizontal position. Wafer check valves are unacceptable. All check valves shall have a working water pressure of 250 PSI.

B. Alarm check valves (wet pipe, dry pipe, deluge, preaction, etc.) shall be provided on all sprinkler risers and have the following.
   1. The alarm check valve (ACV) shall be equipped with a removable hand hole cover assembly, and shall be listed for installation in the vertical or horizontal position.
   2. The ACV shall be equipped with gauge connections on the system side and supply side of the valve clapper.
   3. ACV trim piping and fittings shall be internally and externally galvanized.
   4. Ported alarm connections on the ACV shall be to a retard chamber to absorb variable pressure surges.
   5. Only "Flange x Flange" ACV devices shall be installed.

6. Wet-pipe systems shall use a variable-pressure alarm check valve. Plain-type check valves are not allowed. Sprinkler alarm valve shall be equipped with an external bypass to eliminate false water flow alarms.
7. Dry-pipe valves shall be a positive latching clapper, differential type dry valve and air pressure to water pressure area differential shall be approximately 5 to 1.
8. Deluge valves shall be externally re-settable by hydraulic means, and shall employ a positive vent on the priming line to ensure that the deluge valve will not prematurely reset.

C. Backflow prevention devices shall be installed on all sprinkler systems as follows.
1. A reduced pressure backflow prevention assembly (RPBFP) shall be installed to prevent cross-connection contamination between potable water systems and any fire sprinkler system, at the service connection for the fire sprinkler system.

2.8 FIRE PROTECTION INTERIOR CONTROL VALVES

A. Each system shall have interior control valves as follows:
1. A control valve shall be installed for isolation of each floor of multistory buildings.
2. Interstitial spaces, in-rack sprinkler systems, mezzanines, etc., shall have control valves for system isolation at the feed-main.
3. All control valves shall be provided with an electric valve supervision device, connected to the Fire Alarm System.
4. All inside control valves shall be OS&Y. Butterfly valves are not permitted. Valves shall be manufactured in accordance with AWWA Standard C500, and have a clear waterway equal to the full nominal diameter of the valve. Valves shall be provided with a handwheel, with arrow cast in metal to indicate direction of opening.

2.9 SUPERVISORY DEVICES

A. When specified on the contract drawings, supervisory devices shall be compatible with the Fire Alarm System.

B. Provide the equipment listed below.
1. Electric valve supervision switches shall be installed for all internal (inside) and external (outside) fire protection valves 2-1/2 inches or larger. The devices shall be electrical; single-pole, double-throw; with normally closed contacts and include design that signals controlled valve is in other than fully open position.
2. For wet pipe sprinkler systems, install vane-type waterflow alarm initiation devices with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts and complete with tamperproof cover that sends signal if removed.
3. All vane type waterflow alarm initiation devices shall be equipped with an adjustable delay of audible alarm initiation. Adjustment range shall be from 0 to 120 seconds. Vane type waterflow switch shall be Potter Model VSR-F or approved equal.
4. Waterflow vane-type alarm initiation devices shall be labeled as to the correct orientation of flow when mounted on system piping. When drilling of the system riser it is necessary to mount flow switch, the drilled out disc (coupon) shall be retrieved and attached to the mounting u-bolt of the flow switch.
5. Where pressure operated waterflow alarm initiation devices are used, any valve installed upstream of the device on the alarm line shall be electrically supervised, using the Potter Model BVS or approved equal. Pressure operated alarm initiation devices shall be an electrical-supervision type, waterflow switch with retard feature. The device shall include single-pole, double-throw, normally closed contacts and design that operate on rising pressure and signals waterflow.
   a. EXCEPTION: Where the waterflow alarm initiation device is used only for the purpose of an outside electric bell in lieu of the water motor gong device.
6. Low-pressure supervision shall be installed on all dry pipe or preaction systems and be connected into the Fire Alarm System.
7. Any device that is to be installed in a hazardous location defined by NFPA 70 shall be rated for occupancy.

2.10 FIRE DEPARTMENT CONNECTIONS

A. Fire Department connections shall have a minimum of two 2-1/2” inlets with National Standard Hose (NWSH) threads, internal double clapper check valve, brass plugs, and attached chains.

B. Fire Department connections shall be installed at each new alarm check valve, dry pipe valve, deluge and preaction valve and standpipe, unless the sprinkler system is supplied by a Fire Department connection in the yard main, or as otherwise noted in NFPA 13.

C. The completed installations shall include a metal sign or escutcheon plate, with raised lettering, marked “FIRE DEPARTMENT CONNECTION STANDPIPE-AUTO S0KR,” ‘AUTOMATIC SPKR,” or “STANDPIPE,” as appropriate. Additional signs for systems such as foam water sprinkler systems or other alternative designed systems, as required by other NFPA Standards, shall also be provided by the Contractor where required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Responsibilities
1. The Contractor is responsible for the installation of the automatic sprinkler system in accordance with these specifications and the contract drawings. The Contractor shall coordinate with architectural, mechanical, and electrical, design and construction documents, to ascertain the required information, to affect a properly designed and installed sprinkler system for the building construction and occupancy classification.
2. The installation of the automatic sprinkler system shall be complete with all necessary accessories for proper operation and shall be accomplished by a licensed sprinkler contractor or licensed company regularly engaged in this type of work, and in accordance with requirements of the National Fire Protection Association Standards (NFPA).
3. An individual with a minimum NICET Level II shall supervise the installation.
4. The fire protection system installation shall be coordinated with the other trades (mechanical, electrical, and structural, etc.).
5. The installation shall comply with all mandatory, advisory interpretations, and recommended applicable rules of the latest editions of the standards listed in Section 1.3 of this document, except where otherwise noted on the drawings or specified herein.

B. Contamination and Obstruction Prevention
1. Pipe interiors shall be kept free of debris.

C. Pipe and Fittings Aboveground
1. Pipe, fittings, and hangers shall be installed where shown on the drawings and in accordance with the requirements of NFPA 13.
2. Overhead sprinkler piping, drain and test piping, fire department connection piping, etc. installed through exterior walls shall be galvanized. All sprinkler piping shall be substantially supported from building structure and only UL listed or FM approved type hangers shall be used. Sprinkler lines under ducts shall not be supported from ductwork but shall be supported from building structure (with trapeze hangers where necessary).
3. Flanged Fittings or Mechanical Groove Couplings
   a. Flanged fittings or mechanical groove couplings shall be used at the base of risers, in the risers of multiple-story sprinkler systems at each floor-system connection, and in feed main. Flanged fitting shall be used for alarm valve assemblies.
   b. A flanged tapered reducer shall be installed at the flange and spigot piece when riser is smaller than the underground supply line.
   c. Pipe shall be installed straight and true with no greater deflection at mechanical groove pipe couplings than is recommended by the manufacturer.
   d. Pipe end couplings are not acceptable.
   e. Only rigid-type mechanical couplings shall be used, unless specifically directed by NFPA 13 such as for specific seismic locations. Only in those areas identified by NFPA 13 where flexible type mechanical couplings are specified will the use of flexible couplings be permitted. All other parts of the system shall use rigid-type mechanical groove couplings.
4. Pipe Hangers and Anchors
   a. Hanger rods for all equipment, pipes, ducts, trapezes, vibration isolators, etc., shall be installed straight, true and plumb. Do not bend or flex hanger rods to accommodate sloping structures, avoid obstacles, or for any other purpose. Where necessary, utilize swivel beam clamps, beveled or swivel hardware, angled, swivel or hinged brackets spanning members or other appropriate means of connection.
   b. Offsets in hanger rods will not be permitted.
   c. Concrete anchors shall be installed by drilling and installing a UL listed or FM approved anchor. Explosive driven fasteners as a method of installing anchors or hangers shall not be permitted.
   d. Supports, hangers, braces, etc., shall be attached to the building primary structural members only.
   e. When fastening hangers or braces to bar joists, the fastener shall be located within 4 inches of the panel point on the bar joist.
   f. All piping larger than 4 inches in diameter shall be supported from a minimum of two-bar joists when run parallel to a bar joist.

5. Welded Joints
   a. Welded joints are acceptable when shop fabricated in conformance to provisions of NFPA 13.
6. Screwed Joints
   a. Teflon paste and tape shall be used as pipe-joint compound at screwed joints.
7. Bushings
   a. Bushings shall not be permitted.
8. Control Valves
   a. Control valves shall be provided with identification signs describing the areas protected. Where the valve location is concealed above the ceiling, a sign below the ceiling shall indicate the valve location, and identify the protected area.
9. Wall, Ceiling, and Floor Penetrations
   a. Pipe sleeves shall be installed and properly secured in place at all points where sprinkler piping passes through concrete or masonry construction. Sleeves through all walls and floors shall provide adequate clearance for slight movement of the piping. The guidance in NFPA 13 guidance for seismic areas shall be followed.
   b. Sleeves for pipes passing through floors of concrete or waterproof construction shall project 3 to 6 inches above floors to prevent leakage. Sleeves through walls shall be cut flush with each surface unless otherwise specified. Sleeves shall be caulked to make penetration watertight.
   c. Unless otherwise specified, sleeves shall be of Schedule 40 steel and a minimum of two pipe sizes larger in diameter than the passing pipe.
   d. Holes through walls, floors, and ceilings of other than concrete or masonry construction shall be large enough to accommodate pipe expansion. Holes through existing concrete floors and walls shall be core drilled to provide clean, neat holes. Spaces between pipe and sleeve or pipe and opening for floors and exterior walls shall be filled with a non-hardening sealant material and made watertight.
   e. Where fire rated barriers are penetrated, a UL listed fire barrier system shall be installed to retain the fire resistance rating of the barrier.
   f. Escutcheons shall be provided at wall, ceiling, and floor penetrations of piping in occupied areas.
10. The cutting of structural members for the passage of sprinkler piping or for pipe-hanger fastenings is not permitted.
11. Joints
    a. Joints shall be made in accordance with the requirements of NFPA 13.
    b. Joints shall be left exposed until final inspection and testing have been witnessed.
    c. Swing joints are preferred for connecting pendent sprinklers to branch lines.
12. Dielectric unions shall be used to connect dissimilar metals (such as steel to copper) to prevent electrolytic action.

3.2 SPRINKLER SYSTEM ALARM CHECK VALVES

A. Alarm Check Valves (ACV) shall be provided with internally and externally galvanized trim piping and fittings, pressure gages, a retarding chamber, water motor gong, alarm switch, testing bypass, and all necessary pipe, fittings, and accessories.

B. The retarding chamber drain line shall be piped independently of the main drain line.

C. The drain line from the water motor gong shall be piped to discharge through the wall as close to the grade line as possible.

D. Piping between the ACV and a pressure actuated alarm-initiating device shall be galvanized piping not less than 3/8” nominal pipe size.

E. Piping supplying the retard chamber, water motor gong, and water motor gong drain shall be galvanized. Galvanized fittings are to be used where galvanized piping is required.

3.3 SPRINKLERS

A. Pendent sprinklers below ceiling shall be aligned, and parallel to ceiling features, walls, etc. In areas without a suspended ceiling, install sprinkler piping as high as possible, using necessary fittings and auxiliary drains to maintain maximum clear headroom.

B. Where two sprinkler systems abut, the pendent sprinklers shall be aligned in different directions to distinguish the boundaries of each sprinkler system.

C. Sprinklers under open grating shall be intermediate levels.

D. Sprinklers shall not be installed closer than 6 feet apart.

E. Dry pendant and horizontal dry sidewall sprinklers shall only be installed in screwed tee fittings.

F. Ceiling Areas: Where suspended ceilings are installed, the sprinkler contractor shall install pendent sprinklers as shown on the reflected ceiling plans. Where these plans do not specify the location of the pendent sprinklers, the Contractor shall obtain the reflected ceiling plans and design sprinkler locations at least six inches from ceiling tile edges, 2 feet 6 inches from HVAC supply and return louvers, dimension the locations, follow a repetitive pattern, and locate sprinklers along straight lines to the extent possible. Swing joints shall feed pendant sprinklers from 1” outlet tees in branch lines.

G. Stairs: Sprinklers shall be installed throughout stairways, and at every landing.

3.4 ELEVATOR SHAFTS AND MACHINE ROOMS

A. Sprinklers at the tops of all elevator shafts and in the elevator equipment rooms shall be protected from freezing.

B. Provide an OS&Y gate valve to shut off all sprinkler water flow into the elevator shaft and into the elevator machine room. Where possible, piping should be arranged such that a single valve can shut off water to both locations, and shall be at a readily accessible location, no more than 7’0” above finished floor, inside a clearly marked wall cabinet.

3.5 DRAINS

A. 2” drains shall be installed on all main risers and downstream of any interior sectional valves, and shall be piped to drain.

B. A pressure gage cock and approved gage shall be installed downstream of interior sectional valves of 4” size and larger. 3/4" valve auxiliary drains with standard hose threads and caps shall be installed at all low points in the system, where more than five sprinklers are trapped. Where the capacity of trapped piping exceeds 20 gallons, the overflow shall be piped to drain.

C. Inspector's test connections shall be installed on each sprinkler system as near the most hydraulically remote end of the system as possible. The orifice shall be sized to discharge a flow equivalent to the smallest orifice sprinkler in the system. The inspector's test valve shall be located not more than seven feet above the floor in a visible, easily accessible location. For antifreeze systems, the orifice shall be replaced by a plugged outlet.

D. In multi-story buildings where waterflow alarm devices are provided for each floor or where more than one alarm device is provided in a single sprinkler system, a separate inspector's test connection shall be provided for each alarm device. For convenience, in multi-level buildings where more than one inspector's test connection is required, all the valves shall be manifolded together at a single location on the grade floor, with a sight glass and a common drain line discharging outdoors.

E. Drains shall be piped to discharge to drain, and the discharge shall be visible either by open-end or sight drain fitting.

F. Drains and inspector's test connections through outside walls shall be run through the walls as close to the floor or grade line as possible, terminating with a 45-degree galvanized elbow turned down to splash blocks.

G. Concrete splash blocks, 18” x 18” x 4” minimum in size, shall be installed under each drain or test outlet. The top of the block shall be 1” above grade, with a slope of 1/2" per foot away from the building wall.

3.6 FIRE DEPARTMENT CONNECTIONS

A. The check valve and normally open automatic ball drip (ABD) shall be located at points where they will not be subject to freezing temperatures, and the discharge from the ball drip shall be piped to drain. The ball drip shall close when the flow of water through the valve is in the range of 4 through 10 gpm. All ball drips shall be rated at 175 psi. Use valve- drains in place of automatic ball drip drains when the static head of water above the ABD will exceed 11'6". Check valves shall be UL or FM approved and shall have bodies with the UL or FM stamp.

B. The Fire Department connection shall be installed between 18 inches and 36 inches above grade.

3.7 IDENTIFICATION

A. Control, drain, test, and alarm valves and zone waterflow switches shall be provided with identification signs of the standard design adopted by the automatic-sprinkler industry, or their equivalent.

B. A hydraulic data information nameplate shall be secured to the riser with durable wire, chain, or equivalent, directly above the controlling alarm check valve and shall include the following design data.
   1. Building designation
   2. Location of remote area
   3. Design density
   4. Area of application
   5. System demand (gpm and psi at base of riser)
   6. Data shall be permanently engraved on the nameplate as follows:
      a. Material shall be durable plastic or aluminum; Minimum height of lettering is 1/8”.

C. The Contractor shall furnish and place in a plastic envelope attached to each sprinkler alarm check valve riser, one complete set of typed or printed maintenance and operating instructions, a set of prints of the as-built working drawings and hydraulic calculations of the sprinkler system.

D. Contractor shall supply each riser with a cabinet containing maintenance and repair equipment (spare heads, wrench, etc.)

E. Each Contractor shall affix an identification tag on each system riser indicating
   Name of the Contractor
   Business Address of the Installing Contractor
   Phone Number
   24-hour emergency contact phone number

3.8 FLUSHING

A. Before connecting sprinkler systems to the main supply, each sprinkler supply line shall be flushed out thoroughly by the Sprinkler Contractor through an unrestricted opening not less than 4 inches in diameter. Minimum flowing quantities are specified in NFPA 13.

B. Failure to comply with this requirement shall necessitate flushing of the entire sprinkler system by the Contractor at no additional cost to the Owner.

C. A 4” temporary pipe or two 2-1/2" fire hoses shall be provided by the Contractor to discharge water to a suitable location, as designated by the Architect/Engineer.

3.9 TESTING

A. Aboveground Tests:
   1. Prior to acceptance of the installation, the Contractor shall subject the system to the tests required by NFPA 13 for the completion of the Contractor’s Material and Test Certificate. In addition, complete operating test of dry pipe, preaction, deluge, water-spray and foam water systems shall be performed.
   2. Hydrostatic testing shall be performed before any ceiling is installed below the sprinkler piping. Each water control valve shall be fully opened and closed under water pressure to ensure proper operation.
   3. Where sprinkler locations are roughed-in, using plugged drop nipples projecting below the level of the finished ceiling, the hydrostatic testing shall be performed two times.
      a. First, after the system is completed using the plugged drops, and before the ceiling panels are installed.
      b. Second, after the plugged drop nipples are cut to length for the finished ceiling, or replaced with other drop nipples of the correct length, and the sprinklers installed.
   4. The addition of sodium silicate (also known as water-glass) and related substances before hydrostatic testing, to stop water leakage, is not permitted.
   5. Pipe interiors shall be kept free of debris.

B. Alarm Testing
   1. Contractor shall be responsible for testing new alarms and modified alarms installed under this contract. Defective alarms shall be replaced immediately.

3.10 PROTECTION AGAINST FREEZING

A. Sprinkler piping passing through any unheated spaces in, under, or outside buildings exposed to freezing, shall be protected as shown on the plans or in accordance with the methods specified in NFPA 13. Exposed

to freezing is defined as any location where the temperature may drop below (40°F) 5°C at any time during the year.

B. Heating shall be provided for sprinkler-protected spaces in lieu of providing anti-freeze systems except where otherwise noted on the drawings or specified herein.

3.11 PROTECTION FOR BACKFLOW PREVENTION

A. A reduced pressure backflow prevention assembly (RPBFP) shall be installed on all new systems and where shown on the drawings for modifications to systems to prevent cross-connection contamination between potable water systems and any fire sprinkler system. Install the RPBFP at the service connection for the fire sprinkler system or as noted on the contract drawings.

B. RPBFP assemblies shall be either FM approved or UL listed and be approved by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California (USC-FCCHR) and the International Association of Plumbing and Mechanical Officials (IAPMO).

C. Backflow prevention assemblies used or installed under this contract shall be tested by a “Certified Backflow Control Assembly Tester” who possesses a current (within three (3) years from date of issuance) certificate that confirms successful completion of an approved training course.

D. RDBFP assemblies shall be installed in accordance with AWWA Manual M14 requirements, or as directed by the SDR.

E. If RDBFP devices will be installed outside the building they must be in heated enclosures and with adequate space for inspection, tests, and maintenance.

F. Adequate drainage shall be provided for RDBFP and meet the following:
   1. Discharge shall be piped full size (of the relief valve) and extended to a drain.
   2. Discharge piping shall be sloped 1/8” per foot and be Schedule 40, galvanized.
   3. French Drains are not allowed.

G. The Contractor shall perform an operational test on any new backflow prevention assemblies used or installed under this contract.

3.12 PAINTING AND LABELING

A. Contractor shall paint those portions of fire protection as required by Painting Specification 09900. Labeling shall be as follows:
   1. Sprinkler system (e.g., inspectors tests, drain valves) shall be labeled with all information required by NFPA Standard 13.
   2. Labeling shall be accomplished with the use of permanently marked weatherproof metal or rigid plastic identification signs. The signs shall be secured with corrosion-resistant wire, chain, or other approved means. These signs shall be provided by the manufacturer, manufacturer’s representative, or installer of the sprinkler system.
   3. Sprinkler riser shall be labeled with building and sprinkler system riser numbers. Labeling shall be accomplished with the use of “Brady” or approved equal self-sticking labels. The color and size shall contrast the surface that it is applied to.

3.13 DISINFECTION

A. Piping installed under this contract shall be disinfected per AWWA C651 before it is placed in operation, by using one of the following methods.

B. Continuous Feed Method
   1. Place calcium hypochlorite in pipe sections when installing pipe or inject liquid chlorine into the system via the injection port. Pipe is filled with water and chlorine concentration shall remain at 10 mg/l for a minimum of 24 hours. During this time, all valves in new section will be cycled open and closed to allow for adequate disinfection. Valves connecting the new or repaired line with mains in active service shall remain closed to prevent chlorine pollution.
   2. Samples shall be drawn at 1-, 4-, 8-, 12-, 16-, 20-, and 24-hour marks to determine the chlorine concentration. Acceptable tests are the N-diethyl-p-phenylenediamine (DPD) drop dilution method (AWWA C651, Appendix A) or the High Range Test Kit. The tests shall be done by the Contractor.

C. Slug Method
   1. Similar to the continuous feed method. Follow AWWA C651. Chlorine concentration to be 100 mg/l for a minimum of 3 hours. During this time, all valves shall be cycled open and closed to allow for adequate disinfection. Valves connecting new or repaired lines with mains in active service shall remain closed to prevent chlorine pollution.
   2. Samples shall be drawn every 15 minutes to determine concentration. Acceptable tests are the DPD drop dilution method or the High Range Test Kit. The tests shall be conducted by the Contractor.

D. Repairing or Cutting into Existing Mains
   1. New interior piping surfaces shall be swabbed with a one-percent hypochlorite solution. The section being modified shall be subjected to a high chlorine disinfection process per AWWA C651. The concentration shall be a minimum of 300 mg/l for 15 minutes.
   2. Samples shall be drawn before the chlorine is injected and every 5 minutes thereafter. Chlorine concentration shall be tested by the Contractor using the High Range Test Kit.

E. Flushing
   1. After the lines have been chlorinated using one of the above methods, it becomes necessary to flush the lines with water until test sample indicates that the water is suitable for drinking. The residual chlorine concentration in the water is to be between 0.2 and 2.0 mg/l, as measured using a Low Range Test Kit.

F. Bacteriological Testing
   1. All new and modified water lines require testing for coliform organisms per AWWA C651. The testing shall occur after successful chlorination and flushing of the lines. Samples shall be taken from the new line in sodium thiosulfate treated sterile bottles and analyzed as specified by APHA's Standard Methods for the Examination of Water and Wastewater.
   2. Results shall be recorded with the original documentation of results attached. These will be used for auditing purposes.
   3. Fire protection lines will not be accepted until a negative bacteriological test is performed. Lines will be chlorinated and flushed repeatedly, until such a negative test is accomplished.

END OF SECTION

SECTION 22 00 00 PLUMBING INDEX

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Plumbing Work, as indicated on the Drawings and specified herein. Plumbing work indicated on the Drawings and/or specifications covering other trades shall conform to Division 22 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Plumbing systems shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for plumbing service connections to all the various items of equipment requiring plumbing or piping throughout the project shown on the Contract Drawings (even if not shown on Plumbing Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 PLUMBING DIVISION INDEX

22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 05 23	VALVES
22 07 00	PIPING INSULATION
22 08 00	COMMISSIONING OF PLUMBING SYSTEMS
22 10 00	PIPE AND PIPE FITTINGS
22 11 13	DOMESTIC WATER SYSTEMS
22 11 23	NATURAL GAS PIPING SYSTEMS
22 13 13	SOIL AND WASTE PIPING SYSTEMS
22 14 13	ROOF DRAINAGE SYSTEMS
22 15 00	COMPRESSED AIR PIPING SYSTEMS
22 42 00	PLUMBING FIXTURES
22 66 00	ACID WASTE AND VENT

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 22 05 00 GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General Plumbing Requirements specifically applicable to Division 22 sections in addition to Division 1 - General Requirements.

B. Scope:
1. The work covered by this division consists of performing all operations in connection with the installation of heating, cooling, ventilating, and plumbing including site utility work as indicated under this section. This entire section applies to all mechanical work and all mechanical sections of these specifications. This Contractor shall read and comply with all sections of these specifications including all General and Special Conditions.

1.2 REFERENCES

A. Standard Requirements:
1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. All work shall be executed in accordance with the local and state codes, ordinances, and regulations governing the particular class of work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Where these specifications and accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect/Engineer. The Architect/Engineer shall prepare any supplementary drawings required, illustrating how the work may be installed so as to comply. On approval of the change by the Architect/Engineer, the Contractor shall install the work in a satisfactory manner without additional cost to the Owner. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved, and on completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Architect/Engineer.

C. The Contractor shall secure all permits and licenses for their work and shall pay all fees in connection with such permits and licenses.

D. The contractor shall hold and save the Owner free and harmless from liability of any nature or kind arising from their failure to comply with codes and ordinances.

E. Any and all meter deposits and all utility extension costs shall be paid by the Contractor whose work is done in connection with the service that the meter is connected to.

F. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:

1.	AGA	American Gas Association 1515 Wilson Boulevard Arlington, VA 22209
2.	ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
3.	ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers 345 East 47th Street New York, NY 10017
4.	ASME	American Society of Mechanical Engineers 345 East 45th Street New York, NY 10017
5.	ASPE	American Society of Plumbing Engineers 960 Illuminating Building Cleveland, OH 44113
6.	ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103

7.	AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
8.	AWS	American Welding Society 2501 NW 7th Street Miami, FL 33125
9.	CISPI	Cast Iron Soil Pipe Institute 1499 Chain Bridge Road McLean, VA 22101
10.	FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
11.	FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Building 197 Washington, DC 20407
12.	NBFU	National Board of Fire Underwriters 5530 Wisconsin Avenue, Suite 750 Chevy Chase, MD 20815
13.	NEC	National Electric Code (of NFPA)
14.	NEMA	National Electrical Manufacturer's Association 2101 L Street, NW Washington, DC 20037
15.	NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
16.	NSF	National Sanitation Foundation Box 1468 Ann Arbor, MI 48106
17.	OSHA	Occupational Safety and Health Administration U.S. Department of Labor
18.	PDI	Plumbing and Drainage Institute 5342 Boulevard Place Indianapolis, IN 46208
19.	TIMA	Thermal Insulation Manufacturers Association Technical Services 1420 King Street Alexandria, VA 22314
20.	UL	Underwriters Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

G. Underwriters Laboratories Inc. (UL): All materials, appliances, equipment, devices, or appurtenances shall conform to the applicable standards of Underwriters Laboratories Inc., where such standards have been established.

1.3 DRAWINGS

A. Drawings and specifications shall be considered as cooperative, and work or materials called for by one and not mentioned in the other, or vice versa, shall be done and furnished as though treated by both.

B. In the cases of discrepancies in figures, drawings, or specifications, the Architect/Engineer shall be notified immediately, and their decision shall determine the necessary adjustment. Without such decision, said discrepancies shall not be adjusted by the Contractor save only at their expense, and, in case of any settlement or any complication arising from such adjustment to the Contractor, they shall bear all extra expense involved.

C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Architect/Engineer for such further drawings or explanations as may be necessary, allowing a reasonable time for the Architect/Engineer to supply same, and the Contractor shall conform to same as part of the Contract.

D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Architect\Engineer whose decision shall be final and conclusive. No alleged oral

admission, condonation, or inadvertent neglect on the part of the Architect/Engineer will be accepted as an excuse for inferior work.

E. The mechanical plans do not give exact details as to elevations of ductwork and piping, exact locations, etc., and do not show all offsets, control lines, pilot lines, and other installation details. The Contractor shall carefully lay out their work at the site to conform to the structural conditions, provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated, satisfactory operational installation.

F. Should the particular equipment which any Bidder proposes to install require other space conditions than those indicated on the drawings, the Bidder shall arrange for such space with the Architect/Engineer before submitting their bid. Should changes become necessary on account of failure to comply with these details, the Contractor shall make such necessary changes at their (the Contractor's) own expense.

G. The Contractor shall submit working scale drawings of all their apparatus and equipment which in any way varies from these specifications and plans which shall be checked by the Architect/Engineer and approved before the work is started, Contractor before work proceeds. Interference with structural conditions shall be corrected by the Contractor.

H. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.

I. Utilities: The location, size, and pressure of utility lines are shown in accordance with the data given this office by others. As Architect/Engineers, we cannot and do not guarantee the accuracy of this data. Each Bidder shall check and verify this data. The points of connection to utility lines are approximate only and shall be verified by each Bidder prior to submitting their Bid.

J. Site visit: The Contractor shall visit the site prior to bidding and satisfy themself as the conditions under which the mechanical systems are to be installed. No subsequent allowance shall be made on their behalf for failure to make such a visit. Contractor shall examine all work noted under the demolition drawings and all new work and shall satisfy themself as to the extent of work required to be completed.

1.4 SYSTEM DESCRIPTIONS

A. Not Used.

1.5 PRIOR APPROVALS

A. Each equipment item for which the Contractor desires to install equipment other than the specific item identified in the equipment schedule or equivalent equipment by manufacturers specifically named in the schedule, the Contractor shall bear full responsibility to prove to the Engineer that the furnished equipment is equivalent to or better than the specified item. Failure to provide such proof will result in rejection of the shop drawing submittal by the Engineer. Prior written or verbal approval by the Engineer of equipment by other manufacturers will not relieve the Contractor of responsibility to provide equivalence. Prior approval is required, however, any prior approval given is intended only to provide preliminary agreement that the alternate manufacturer may make equipment that complies with the specification requirements and not that all equipment manufactured by them is acceptable.

1.6 SHOP DRAWINGS

A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this Contract. This shall include piping, ductwork, mechanical equipment, plumbing equipment, control items, etc. The Contractor shall submit to the Architect/Engineer a sufficient number of copies of all such shop drawings or catalog data to provide them with as many review copies as they may need, plus three (3) copies for retention by the Architect/Engineer. No materials or equipment shall be installed until officially approved by the Architect/Engineer.

B. Before submitting Shop Drawings to the Architect/Engineer for review, the Contractor shall examine them and satisfy themself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of Shop Drawings is not intended to take the place in any way of the official review of the Architect/Engineer, and the Shop Drawings which have not been reviewed by the Architect/Engineer shall not be used in fabrication or installing any work.

C. The review of Shop Drawings or catalog data by the Architect/Engineer shall not relieve the Contractor from responsibility for deviations from the plans and Specifications unless they have, in writing, specifically called

attention to such deviations as the time of submission and has obtained the permission of the Architect/Engineer thereon, nor shall it relieve them from the responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect/Engineer, they shall state in their letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

D. After receiving approval on the make and type of materials, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is done to facilitate progress on the job and failure on the part of the Contractor shall render them liable to stand the expense of any and all delays occasioned by failure on this part to provide necessary details. All shop drawings shall be delivered to the Architect/Engineer's office within thirty (30) days from the date of the contract.

E. Shop drawings will be returned unchecked unless the following information is included: reference to all pertinent data in the Specifications or on the drawings, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.

1.7 SUBMITTALS

A. Submittal data shall be organized in commercial quality, three ring binders with durable and cleanable covers. Product information for each piece of equipment shall be separated by an indexing leaf with clear tabs. The product name and symbol (i.e., AHU/Air Handling Unit) shall be typed on white paper inserts and placed in appropriate tab. Complete data must be furnished showing performance, quality, and dimensions. A signed review by the Architect/Engineer must be obtained before purchasing any equipment.

B. The following items shall be submitted for review by the Architect/Engineer but are not limited to:
1. Pipe Insulation
2. Coils
3. Plumbing Fixtures and Trim
4. Cross Connection Control Devices
5. Evaporative Coolers
6. Pumps
7. Hydronic Air Control Devices
8. Plumbing Equipment
9. Heat Exchangers
10. Flexible Pipe Connections
11. Heating Terminal Equipment
12. Roof Top Equipment
13. Fire Protection Equipment
14. Radiant Heating Equipment
15. Vibration Equipment and Calculations

1.8 QUALITY ASSURANCE

A. General: Comply with Division 1.

B. Welder Qualifications: Welders shall be certified by the American Society of Mechanical Engineers (ASME) National Certified Pipe for the type of work being performed. Current operators' certificates in accordance with ASME standards shall be on file at the site and shall be available to the Architect/Engineer for examination. Coupons shall be available for review by the Architect and Engineer.

C. Locations of all pipes, ducts, outlets, appliance, etc., as shown on the drawings, are approximate only and are understood to be subject to such revisions as may prove necessary or desirable at the time the work is installed. Each Contractor will be required to install their work with relation to existing building conditions and shall be entirely responsible for the correctness of their work with reference to finished elevations, etc. Piping shown on the drawings is diagrammatic only and their exact locations, depths, and invert elevations shall be as required for proper flow and coordination with other trades.

D. The contract drawing depicts graphically the arrangement of piping and ductwork. Should local conditions necessitate a rearrangement, or if any of the piping or ductwork can be installed to better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit three (3) copies of Drawings of the proposed arrangement for the Architect/Engineer's review.

E. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, they shall assume full responsibility for the

rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such change shall be accompanied by Shop Drawings of the space in question.

F. Each Contractor is responsible for the proper location and size of all slots, holes, or openings in the building structure pertaining to their work, and for the correct location of pipe sleeves.

G. Each Contractor shall coordinate their work with that of all other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines which require a stated grade for proper operation. Drainage lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

H. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Lubricate all equipment properly in accordance with manufacturer's instructions. Furnish zerk grease fittings on all greaseable bearings.

I. Equipment and Materials: The materials and equipment shall be new and shall be the standard products of the manufacturers regularly engaged in the production of Plumbing, Heating, Cooling, Ventilation, and Fire Protection Equipment, and shall be the manufacturer's latest standard design. Where two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer. However, the component parts of the systems need not be the products of the same manufacturer. Specific equipment specified hereinafter is to be considered a standard of quality and operation. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the drawings. Reference shall be made to the schedules for specific information. The capacities shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Architect/Engineer. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the plans, the manufacturer's instructions shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is to be installed.

J. Excavation and Backfilling: This Contractor shall do all necessary excavation and backfill for the installation of the Mechanical systems as may be required. Curb cuts, asphalt, and concrete patching, cutting, and patching existing floor, etc., shall be part of this Contractor's responsibility. No extra payment will be made for rock excavation. Trenches for all underground piping shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to assure the pipe resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe, and before laying the pipe, the space between the bottom of the pipe and the rock surface shall be filled with gravel, thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down in the trenches and shall be filled. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. The backfill material shall be identical to the surrounding fill material and shall be placed in a 6-inch layer, wetted, and compacted to the density of the adjacent soil. See Division 2 for additional information for site utilities. All surplus materials shall be hauled from the project by the Contractor at their expense.

K. Cutting and Repairing:
   1. Responsibility of the Contractor whose work is involved. Coordinate with others to prevent unnecessary cutting and repairing.
   2. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports. Arrange with those whose work is involved to do cutting and replacing caused by negligence or error with costs reimbursed by the Contractor at fault. Cutting and replacing of existing work shall be the responsibility of the Contractor whose work is being installed.
   3. Removal or terminating connections of existing work which is abandoned or replaced shall also be done hereunder to provide correct and finished work.

L. Foundations: All equipment shall be provided with suitable foundations and supports. It shall be the responsibility of the Contractor to provide for the proper locations of these foundations and supports. This applies to all rooftop equipment also.
   1. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) the conformity with the recommendations of the manufacturer of the respective equipment, and with the approval of the Architect/Engineer. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow 1 inch below the equipment base for alignment, leveling and grouting with nonshrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed.

2. Unless otherwise noted, foundations shall be a minimum of 6 inches high. All concrete work performed by these Contractors shall conform entirely to the requirements of the Concrete Specifications which describe this class of work.

M. Code Requirements: Comply with state and local code requirements and ordinances. Call for inspections required by responsible building inspection authority.

N. Applicable Building Codes and Ordinances: Including the latest edition of each code, but not limited to the following:
1. International Building Code.
2. Uniform Mechanical Code.
3. Uniform Plumbing Code.
4. Governing Fire Department Requirements
5. Utility Company Requirements
6. National Fire Protection Association Standards
7. NFPA 70 - National Electrical Code
8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
9. NEPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
10. NFPA 13 - Sprinkler Systems
11. NFPA 101 - Life Safety
12. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment
13. International Energy Conservation Code 2021

O. Access Panels
1. Similar to Milcor, or as noted on the drawings, size as required for concealed expansion joints, valving, gauges, balancing dampers, valves, traps, pitot stations, equipment and similar items requiring accessibility. Notify the General Contractor of each access panel location and the required size. Panels shall be proper type for ceiling or wall in which they are installed. The panels shall be furnished under this section of the Specifications, unless otherwise directed, but shall be coordinated to be compatible with walls and ceilings furnished under other sections.

1.9 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1.

B. Large Items: Make arrangements with other trades on the job for introduction into the building of equipment too large to pass through finished openings.

C. Acceptance: Check and sign for materials to be furnished by others for installation under Division 22 upon delivery. Contractor shall be responsible for the storage and safekeeping of such materials from time of delivery until final acceptance.

D. Protection: Close ends of pipe at the close of each working day during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work with heavy paper or plastic until final clean-up.

E. Storage: Store equipment in covered enclosure or wrap with weather tight 6 mil Visqueen.

F. Shipping Protection: Protective casings, crating, and coverings to remain in place until start-up of equipment.

1.10 PROJECT CONDITIONS

A. Performance: All systems are to be rated at 4,000 ft. elevation.

1.11 SEQUENCING AND SCHEDULING

A. General: Comply with Division 1.

B. Schedule: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.

C. Utility Interruptions: Schedule mechanical utility interruptions with the Architect/Engineer/Owner minimum of seven (7) days prior to the requested outage. Plan work so that duration of the interruptions a maximum of one day.

1.12 CONTROLS WIRING AND ELECTRICAL EQUIPMENT

A. All mechanical equipment controls wiring, conduit, relays, interlocks, and all accessories required for a completely operational controls system shall be the complete responsibility of the mechanical contractor. The mechanical contractor has the option to hire the project electrical contractor or any qualified controls contractor to install mechanical controls wiring and conduit. Refer to Specification Sections 25 09 00 and 25 30 00 for coordination requirements between mechanical, electrical, and controls subcontractors.

B. Electrical items such as disconnect switches and motor starters associated with equipment provided by Division 22, when specifically mentioned to be furnished by the Mechanical Contractor, whether in these specifications or on the Electrical or Mechanical Drawings, shall be furnished by the Contractor. These items shall be mounted and connected as required for a completely operational system. See Control Systems Specification for further information.

C. All electrical equipment characteristics (voltage, etc.) must be verified by the Contractor prior to ordering. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, they shall first inform the Architect/Engineer of the change and shall then coordinate the change with the Electrical Contractor and shall pay all additional charges in connection with the change.

D. All motors shall meet all the requirements of all Electrical Divisions.
   1. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general-purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. All motors shall have copper windings. All motors to have minimum power factor of 85% or have switched correction to 90%. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 40°C rise and total temperature rise of 65°C ambient and when powered from the system voltage feeding the motor. TEFC motors shall a service factor of 1.00 with total temperature is of 65°C in the above conditions. Motors located in areas exceeding 40°C ambient shall be factory-rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Type N split phase induction motors with built-in thermal protectors. Single phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors. Single phase motors of 1/10 HP or less may be shaded pole induction motors.

1.13 PROTECTION AGAINST HAZARDOUS CONDITIONS

A. The Contractor shall take precautions against hazardous construction conditions at all times during construction. The final condition of the facilities shall be safe, and where safety to operating personnel is jeopardized, suitable signage shall be posted.

B. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operating personnel, shall be cut back and/or protected to reduce the risk of injury. All openings between floors shall be protected with barriers around the openings, gratings across the openings, or steel bars through the openings to avoid and protect against injury.

1.14 HAZARDOUS SIGNS

A. Equipment room contains moving or rotating parts, floor openings, or other potentially hazardous environments and shall include a sign on the door entering it that shall read similar to the following: **Hazardous Area - Authorized Personnel Only.**

1.15 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Mechanical Contractor shall furnish to the Owner a bound (three (3) ring binder) manual in triplicate, containing complete repair parts lists, and operating, service, and maintenance instructions on all mechanical equipment, fixtures, and systems, as noted below:
   1. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Sub-consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
   2. For Each Product System: List names, addresses and telephone numbers of Sub-contractors and suppliers, including local source of supplies and replacement parts.
   3. Product Data: Mark each sheet to clearly identify specific product and component parts, and data applicable to installation. Delete inapplicable information.
   4. Warranties and Bonds: Bind in copy of each.
   5. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

6. Include color-coded wiring diagrams as installed for control system.
7. Operating Procedures: Include start-up, break-in and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating instructions.
8. Maintenance Requirements: Include routine procedures and guide for troubleshooting, disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
9. Provide servicing and lubrication schedule and list of lubricants required.
10. Include manufacturer's printed operation and maintenance instructions.
11. Include sequence of operation by controls manufacturer.
12. Provide original manufacturer's part list, illustrations, assembly drawings and diagrams required for maintenance.
13. Provide control diagrams by controls manufacturer as installed.
14. Provide charts of valve tag numbers, with locations and functions of each valve, keyed to flow and control diagrams.
15. Provide list of original manufacturer's spare parts and recommended quantities and to be maintained in storage.
16. Include Test and Balance (T&B) Reports as specified in Section 23 05 93.

B. The Mechanical Contractor shall also provide training as required by Section 23 01 00 to the Owner's operation and maintenance personnel.

1.16 OPERATION PRIOR TO ACCEPTANCE

A. The Owner shall have the right to operate any and all apparatus as soon as and as long as it is in operating condition, after Owner personnel have received operational training, whether or not such apparatus has been accepted as complete and satisfactory, except that this shall not be construed to mean operations before any required alterations or repairs have been made. This operation does not indicate acceptance of the equipment by the Owner. When the Contractor enters into a contract with the Owner, they agree to the above.

1.17 WARRANTY AND SERVICE PROGRAM

A. Due to the critical performance requirements and to clearly establish warranty responsibility for this project, the Contractor shall provide a full-service maintenance and warranty program to the Owner for one full year after beneficial occupancy (substantial completion).

B. This service program shall be included as part of the base bid and shall include service, maintenance, repair, replacement, lubrication, temperature control calibration and repairs, and documenting proof for all service and maintenance work on all equipment and system furnished by the Contractor.

C. A single representative in the employment of the Contractor shall be responsible for coordination and follow through of this program. This representative's name and phone number shall be submitted to the Owner as part of the maintenance manuals and supportive data. The Contractor shall respond to a request for service with 24 hours if so requested.

D. During this first year of operation, the following sequence of maintenance service shall be performed as a minimum.
1. Clean strainers in piping.
2. Fans and/or pumps be lubricated and oiled once every four (4) months.
3. Controls shall be calibrated throughout the facility at the end of six (6) months (following substantial completion). Any leaks in the piping systems shall be repaired.
4. All equipment manufacturer's service recommendations shall be followed during this period.

1.18 FLUSHING AND DRAINING

A. It shall be the responsibility of this Contractor to properly drain and flush all ducts and pipes before use or acceptance to ensure that all debris is completely removed. Damage caused by such debris remaining in the ducts or pipes shall be repaired by this Contractor at their expense. This Contractor shall demonstrate to the Architect/Engineer's representative that all piping is clean.

1.19 CLEANING

A. This Contractor shall remove from the building construction site all rubbish and dirt as it accumulates under the contract. At completion, all areas shall be broom cleaned and all obstructions, surplus materials, etc., removed.

1.20 GUARANTEE

A. The Contractor shall guarantee all materials, equipment, and workmanship furnished and installed by them under this Contract, to be free from all defects of workmanship and materials, and shall agree to replace at their expense, without expense to the Owner, at any time within one year after installation is accepted by the Architect/Engineer, any and all defective equipment, parts, etc., that may be found. (This excludes normal maintenance and daily servicing of equipment which is the Owner's responsibility.)

1.21 FLOOR, WALL, AND CEILING PLATES

A. Where exposed pipes pass through floors, finished walls, or finished ceiling, they shall be fitted with chromium-plated escutcheons of an approved pattern. Escutcheons and plates in Mechanical Rooms do not require chrome finish.

B. This Contractor shall be responsible for providing and installing all counter flashing. All openings in the roof shall be flashed and counterflashed. Use four-pound lead flashing materials for all vent lines and welded flashing in steel lines passing through roof. The Mechanical Contractor shall notify the General Contractor where each roof penetration is and the size of the opening.

1.22 PIPE SLEEVES

A. Schedule 40 steel pipe sleeves or pipe sleeves made of No. 20 gauge galvanized steel, properly secured in place with approximately 1/4" space between each sleeve and the surface of the pipe and/or insulation passing through it, shall be provided for all pipes passing through concrete floors, roofs, and masonry walls. All pipe sleeves shall be fixed in place as the walls and floors are built up. The Contractor shall furnish and locate all sleeves and pipes passing through concrete floors, exterior masonry walls, and roofs shall be made watertight with approved non-hardening plastic material. Sleeves through pipe chase or equipment room floors shall project a minimum of 2 inches above the floor and shall be of black steel pipe with waterproof flange at center of floor thickness. Each sleeve through a fireproof wall shall be packed with approved fireproof rope in the annular space.

1.23 PIPE HANGERS

A. Pipe hangers shall be Fee and Mason of a type suitable for each use. Perforated straps shall not be used in any work. For ferrous pipes up to and including 4 inch in size, use Fee and Mason Fig. 199 malleable iron, adjustable, split ring, swivel hanger. For plumbing piping larger than 4 inches, use Fee and Mason Fig 239 steel clevis hanger. Where several pipes are parallel at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where indicated on the Drawings. For copper pipes up to and including 3 inch in size, use Fee and Mason Fig. 360 malleable iron, copper plated hangers. For copper pipes larger than 3 inches, use Fee and Mason Fig. 364 copper plated clevis hanger.

B. Hanger rod sizes shall conform to the following schedule:

1.	Pipe up to and including 2"	3/8" rods
2.	Pipe 2-1/2", 3" and 3-1/2"	1/2" rods
3.	Pipe 4" and 5"	5/8" rods
4.	Pipe 6"	3/4" rods
5.	Pipe 8”, 10”, and 12”	7/8” rods

C. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following spacing:

1.	Pipe up to and including 1-1/4"	8'
2.	Pipe 1-1/2" and 2"	10'
3.	Pipe 2-1/2" and 3"	12'
4.	Pipe 3 1/2” and 4”	14’
5.	Pipe 5” and 6”	16’
6.	Pipe 8” and 10”	20’

D. Unless shown otherwise on the Plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction as the case may be, by means of hangers with the following maximum spacing:

1.	Pipe up to 3/4" in size	5'
2.	Pipe 1" and 1-1/4"	6'
3.	Pipe 1-1/2" and larger	10'

E. There shall be a hanger within 2 inches of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length of pipe. Vertical risers shall be supported by approved riser clamps at each floor. Vertical pipes within a space shall have not less than two supports.

F. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting, nor shall it be supported from equipment connection.

G. Expansion bolts shall be Ackerman-Johnson or Hilti.

H. Beam clamps suitable for use with this type of steel construction involved shall be Grinnell.

1.24 PRESSURE VESSEL CERTIFICATION

A. Not used.

1.25 ISOLATION

A. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical Contract will be extremely objectionable and the Contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them, and consequently, they shall design all foundations, supports, etc., for their equipment, and all piping with this end in view. In addition, these Contractors shall supervise the construction of all foundations and supports, whether they build them or not, in order that they may be constructed in such a manner as to prevent the transmission of objectionable noise and/or excessive vibration. Submit calculations on all vibration isolation equipment.

B. All equipment having moving parts shall be isolated from the building structure by means of Korfund isolation materials, unless specifically noted otherwise. All isolators shall be the same brand and shall be supplied from the same source. Equipment manufacturer's recommendations shall be followed in the isolation of equipment.

C. Vibration isolators shall have sufficient resilience to meet the following minimum efficiencies:

Motor HP	Equipment Room
Up to 5	90%
7-1/2 to 15	93%
20 to 40	95%
50 to 100	97.5%

D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the baseplate, or may be unhoused stable springs. Isolators shall be furnished with snubbers and limit stops where so recommended by the equipment manufacturer.

E. The Supplier of the isolating equipment shall, upon completion of the job, check all isolating materials and verify that they are installed properly, and submit a report in writing to the Architect/Engineer.

1.26 TESTING

A. Before completion of this project, the Mechanical Contractor shall test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the Specification requirements, whichever is more stringent.

B. All equipment shall be operated sufficiently long enough to prove to the Architect/Engineer that the equipment performs satisfactorily and meets the requirements set forth on the Plans or in these Specifications.

1.27 CERTIFICATIONS

A. Before receiving final payment, the contractor shall verify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications. Submit certifications and acceptable certificates to the Architect/Engineer.

1.28 GENERAL PIPING INSTALLATION REQUIREMENTS

A. Provisions for Drainage: All piping systems shall be installed so that they may be easily drained. Drain caps, plugs, or hose bibbs shall be installed at low points. Grade piping toward drain locations.

B. Alignment: All installed pipelines shall be straight and shall remain straight against strains. Proper allowance shall be made for expansion and contraction.

C. Clean as Installed: All piping shall be kept free from scale or loose dirt when installed, and must be kept clean during the completion of the installation. All openings in the piping system shall be capped or plugged while awaiting further connections. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the system in which they are used. They shall not adversely affect the materials of mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents, and other cleaning agents shall also be compatible with the process streams to be handled by the systems in which they are used.

D. Insulated Fittings: Install between any dissimilar metals such as steel and copper.

E. Expansion and Contraction: The Contractor shall make all necessary provisions for expansion and contraction with proper fittings, anchors, dresser couplings, loops, etc. Install flexible connectors on each pipe at each building expansion joint.

F. Welding: Refer to Paragraph 1.29 of this section of these specifications.

G. Bending: No bending of pipe will be permitted.

H. General: The installation shall be coordinated with respect to space available with heating, cooling, ventilating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows, shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping, installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings or as recommended by the equipment manufacturer. Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work, and not less than 1/2 inches between finished covering on the different services.

I. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified and where directed at site. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.

J. All valves which must be used during operation, all control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation shall be located conveniently accessible from an operating platform or grade.

K. In general, relief valves within processing unit limits shall be located conveniently accessible from an operating platform or grade.
   1. Those in non-hazardous service, such as water, shall discharge directly to outside.
   2. Relief valves should have no piping between the vessel or line and the valve inlet, except as shown on the drawings.
   3. Relief valves shall be installed in a vertical position. Vent piping shall be braced and supported in a manner that will not produce excessive stresses in the relief valve and will permit removal of the relief valve without necessary temporary supports for the vent lines.

L. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings. Provide removable headers for large equipment for service access.

M. Joints
   1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be turned off. All flanged bolt holes shall straddle the horizontal and vertical center line unless otherwise noted.
   2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1 Latest Edition. Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.
   3. Solder-Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool or wire brush before seating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for serrated fittings on water, compressed air below 60 psig, and vacuum lines shall be made with a 95 percent tin and 5 percent antimony. Cored solder or solder containing lead will not be permitted.

N. Reducers: Reduction in pipe size shall be made with one piece reducing fittings. Bushings reducing at least two pipe sizes will be acceptable only when there is no room for reducing couplings or swaged nipples.

O. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union Pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.

P. Hanger Supports:
   1. All hanger rods used to support piping, conduit, mechanical units, equipment, trapezes, and other items shall be straight and installed plumb, regardless of length. Do not bend rods to adapt to sloped or rotated structural members, secondary support members or to sloped mounting holes on supported equipment. Contractor shall utilize available swivel, hinged, or rigid mounting techniques designed to accommodate a slope or rotation, or shall design a custom solution. Selected techniques for each application shall be submitted for approval prior to use.
   2. Do not bend rods to circumvent an obstruction.
   3. Loads on hanger rods shall be applied in direct tension. Do not apply compression, lateral or moment loads to hanger rods. Install bracing or additional supports to prevent hanger rod from incurring non-tension loading.
   4. Do not create offsets in rods; use only in-line couplers, and only when length of coupled rod exceeds standard available length (typically 12 feet), or when full lengths cannot be placed in position. Provide additional horizontal bracing to prevent swaying of supported piping or equipment.
   5. Do not straighten bent rods for subsequent use. If a rod becomes bent, cut off and discard the bent portion. Remaining straight portion of rod may be used.

1.29 WELDING

A. All welding of piping covered by this specification, regardless of condition of service shall be accompanied as follows:
   1. The welding shall be in accordance with the recommendations of the American Welding Society. Mitering of pipe to form elbows, notching to form these, or any similar construction will not be permitted. Welding fittings shall be installed on all welded lines. Joints to be welded shall be properly aligned and spaced, using special welding clamps where necessary. All welders to be employed shall have passed qualification tests prescribed by the National Certified Pipe Welding bureau (or by another reputable testing laboratory or agency) using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The welders will be required to pass qualification tests when the work of the welder creates a reasonable doubt as to their proficiency. Tests shall be conducted at no additional expense to the Owner.
   2. Each welder shall, in addition to having passed the prescribed qualification tests (as noted in Paragraph 1.29.A.1), prepare sample coupons at the job site on a portion of pipe that is cut such that the cross section of the weld is open to view. The sample weld should be prepared using a 6-inch diameter pipe. The sample shall reflect a continuous weld with perpendicular cut out to show the weld in cross sectional view. This sample, when accepted and approved by a certified welding inspector, shall be used as a standard of quality to compare to other welds that this welder will be performing on the job. This same sample weld will also be a basis for accepting or rejecting the welder for working on this project. The sample weld shall be identified with a date and the welder's name and shall be kept at the site throughout the project.
   3. All welding on pressure piping shall conform to all of the requirements of the American Society of Mechanical Engineers Code for Pressure Piping - B31.1 (An American National Standards Institute publication), as defined in the latest edition of the ANSI Power Piping B31.1 Manual. All welding shall also conform to all of the requirements of the American Society of Mechanical Engineers Boiler and

Pressure Vessel Code. All chapters, current addenda and supplements of these manuals shall apply. This code shall be used to establish standards of performance and quality of welds. However, the Owner reserves the right to perform radiographic testing of all welds, to compare any of the welds to the approved "standard" sample welds of each welder, and to compare the welds to the welding diagrams and sketches of those recommended in the ANSI B31.1 Power Piping Manual. The intent is to obtain the highest quality welding job possible. The cost of any initial radiographic testing, for random inspection, shall be paid for by the Owner. If radiographic random testing reveals that a weld is defective, the Contractor shall bear the cost of all repairs and re-testing necessary to be made to subject weld until conformance with radiographic tests is reached. The potential for random radiographic testing and welding quality control applies to all pressure piping systems in this project, including systems below 100 psig. If a question should arise regarding the possibility of faulty welding or if there are obvious visual defects in the welding, the Contractor shall be required to correct such deficiencies to a quality level consistent with the recommendations, welding diagrams and sketches in the ANSI B31.1 Manual. The quality level shall also reflect that of the approved sample welds accomplished by each welder for this particular project.

1.30 TESTING FOR PIPING SYSTEMS

A. General: Before insulation is applied, all piping, equipment, and accessories installed under this contract shall be inspected and tested by the Contractor. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying tests. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with water (liquid lines only) at a sufficient flow rate and period of time, to ensure complete cleaning of the lines of all dirt, scale, and foreign matter. Satisfactory flushing of the lines shall be subject to approval. After testing and flushing lines, all filters and strainers shall be cleaned.

B. Safety: Since the Risk of failure, with the attendant possibility of injury, is appreciable greater with further testing, all safety measures required by codes or ordinance or reasonable applicable to the situation shall be taken.

C. Concealment: Equipment or piping to be pressure tested shall not be insulated, covered, or concealed prior to that test. Compression joint underground piping may be backfilled prior to pressure test except that joints shall remain exposed until after the test, but tie rods, clamps, etc., shall be in place and fastened.

D. Pressure Ratings: These tests shall not be used to establish pressure ratings.

E. System Protection: Protect all piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during the filling, testing, and draining procedures. Seats of iron valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Pressure tests against other closed valves shall not exceed twice the normal rating. Note that where significant differences in elevation exists, there is a risk of overpressure in the lower portions of the system in order to attain test pressure in the upper portion of the system.

F. Test Temperature: Apply test pressure only after the system and test medium are at approximately the same temperature, preferably not less than 60°F. Note that some applicable codes require testing above a specified minimum temperature.

G. Sectionalizing: Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.

H. Temporary Supports: During hydrostatic testing of lines provide temporary supports to prevent overstressing supports or hangers. When tests are completed, remove all temporary supports, locks, stops, etc., and adjust supports for their cold load and alignment.

I. Testing: Domestic hot and cold water piping and heating water piping shall be tested hydrostatically at the test pressures specified and shall show no drop in pressure in a 2-hour period. Leaks shall be located by soap testing.
   1. Test Pressures:
      a. Natural gas piping: as required by governing code
      b. Domestic Hot and Cold Water: 100 psig or 50% more than operating pressure, which ever is greater.
      c. Condenser or Tower Water Supply & Return: 100 psig.

d. Heating Water Supply and Return: 100 psig.
e. Chilled Water Supply and Return: 100 psig.

J. Sanitary Waste and Soil System:
1. After all soil and waste pipes and vent stacks have been installed, the outlets shall be plugged, and the piping system filled with water in vertical sections to the highest point of the system and allowed to remain filled for twenty-four (24) hours and shall prove to be leaktight under such conditions. A one-inch drop will be allowed in water level in standpipe. This test may be conducted in segments as required by the sequence of construction. Contractor shall certify in writing that all tests were satisfactorily completed before piping was concealed, and shall submit the certification to the Architect/Engineer for their records and for transmittal to the owner.

K. Test Report
1. A detailed report of pressure tests on piping and equipment shall be forwarded in duplicate to the Architect/Engineer. This report shall show date of test, lines tested, test medium, length of time test pressure was held, pressure drop or rise, and extent of venting or repressurizing.

1.31 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other sections of these specifications covering the work of other trades which must be carried out in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay, or absence of coordination.

1.32 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions covering the mechanical work at the building. No extra compensation shall be claimed or allowed on account of difference between actual dimensions and those indicated on the drawings. They shall examine the adjoining work on which Mechanical work is dependent for maximum efficiency, and shall report any work which must be corrected. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting Mechanical work.

1.33 SAFETY GUARDS

A. The Mechanical Contractor shall furnish and install safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded. Provide coupling guards on all rotating shafts.

1.34 PROTECTION

A. All work, equipment, and materials shall be protected at all times to prevent obstruction, damage, or breakage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected against dirt, water, chemical, or mechanical injury. At the completion of the work, all equipment shall be thoroughly cleaned and the entire system shall be delivered in a perfect, unblemished condition.

1.35 PAINTING AND IDENTIFICATION

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance.

B. Except as elsewhere hereinafter specifically required, any painting of equipment, piping, ductwork, grilles, insulation, etc., furnished and installed under this Section of the Specifications will be done by the Painting Contractor. However, the Mechanical Contractor shall leave their equipment clean and free from any grease, dirt, rust, etc., and in suitable condition for painting.

C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.
D. The piping shall be painted the basic color as indicated in other sections of these specifications and shall be marked every 10 feet on centers with Brady pipe markers. Arrows, approximately 6 inches in length and spaced about 10 feet on centers shall indicate the direction of the flow pipe. Locate additional labels as required in Mechanical Rooms. Staple in place, brush with clear lacquer. Markers shall state pipe size, flow direction, and pipe usage (such as "cold water," etc.).

1.36 RECORD DRAWINGS

A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all dimensional locations of equipment piping and all deviations and/or changes in the work shall be recorded. Water, storm, and drainage mains shall be delivered to the Architect/Engineer in good condition upon the completion and acceptance of the work and before final payment is made.

1.37 SUPPLIER RESPONSIBILITY

A. Each supplier, whether furnishing equipment as specified or as a substitution shall be responsible for certifying that the equipment is properly installed and that the warranty is valid. Submit written reports on the installation and the equipment performance when requested to do so by the Architect/Engineer (or their representative). Each supplier shall be responsible for furnishing qualified personnel at the job site at any time requested by the Architect/Engineer (or their representative) during the construction or warranty periods.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 22 05 13 COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. It is the intent of this specification to define all motors furnished under all sections of the specifications for this project which will provide efficient operation, reliability, ease of maintenance, and repair along with reduced operation costs.

B. All general-purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. Motors shall be rated explosion-proof when located in hazardous atmospheres.

C. Motors mounted in direct sun shall be provided with a shield to forbid direct radiation from the sun when the sun is 45 degrees or greater above the horizon.

D. All supply fan motors mounted in air handling units shall have Class F insulation.

E. Open drip-proof motors shall be NEMA design B with Class B insulation and a 1.15 service factor with 40-degree C ambient and a total temperature rise of 65 degrees C.

F. TEFC motors shall be NEMA design B with Class F insulation and a 1.15 service factor with 40 degree C ambient and a total temperature rise of 65 degrees C.

G. Severe duty motors shall be NEMA design B with Class F insulation and a 1.15 service factor with 40-degree C ambient and a total temperature rise of 65 degrees C.

1.3 GENERAL

A. All motors covered by this specification shall conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC Standards. They shall be free from defective material and workmanship and fully capable of performing in accordance with the manufacturer's nameplate rating.

B. Motors shall be approved by Underwriter's Laboratories (UL) for the service specified.

C. Unless otherwise specified, motors shall be suitable for operation in either direction--(CW or CCW) or rotation.

D. Motors shall be Westinghouse II, Reliance XE, Gould E-PLUS, GE Energy Savery, or approved equal.

E. All fractional H.P. motors shall be permanent split capacitor (P.S.C.) with U.L. listed overload protection. The protector shall be calibrated to trip out when the winding reaches a pre-determined temperature and automatically reset when the temperature returns to a safe limit.

1.4 EFFICIENCY

A. All motors shall be special high efficiency design. These motors shall be different than manufacturers' standard product, in that losses are reduced by incorporation of design features including the use of low loss lamination steel, increase in stator/rotor length, increase in copper windings, utilization of high efficiency ventilating fan, computer optimized slot configuration and air gap.

B. All motors shall be all copper wound, high power factor, high efficiency motors. Motor efficiency shall be as determined by IEEE Standard 112A, test method B. Test results shall be submitted to the Engineer.

C. Manufacturer to furnish % efficiency, % PF, amps at Full Load, 3/4 Load, and 1/2 Load with quotation and be prepared to furnish actual test results on individual ratings if required.

PART 2 - PRODUCTS

2.1 GENERAL

A. Motors shall be 60 Hertz voltage as indicated on drawings, Squirrel Cage induction type suitable for across-the-line starting and continuous duty.

B. Motors shall have copper windings.

C. All motors shall be suitable for application without exceeding Class B rise in ambient temperatures up to and including 65 degree C at 1.15 Service Factor. Motor nameplates shall state suitability for 65 degree C ambient application.

D. All motors shall be suitable for application without exceeding Class B temperature rise at altitudes up to and including 9900 feet at a 1.00 Service Factor.

E. Motors shall operate successfully under running conditions at rated load with +10% of rated voltage or +5% of rated frequency or a combined variation in voltage and frequency of +10% (sum of absolute values).

F. Motors will have at least a nominal 85% power factor rating at full load and rated voltage. Exclusion from this requirement are motors which draw less than 1,000 watts at full load and motors with synchronous speeds less than 1800 RPM. Test verification shall be available upon request.

2.2 INSULATION

A. Motors shall have non-hygroscopic Class B or Class F insulation system as required; however, temperature rise shall not exceed Class B rise at rated load per NEMA Standards.

B. The insulation system shall be provided with sufficient treatment so that the completed insulation system will have a minimum resistance of 1.5 megohms after 168 hours of testing to a humidity chamber maintained at 100% relative humidity and 40 degree C ambient.

2.3 TESTS

A. Each motor shall be given a routine factory test per NEMA and ASA Standards to ensure compliance with this specification.

2.4 BEARINGS

A. Bearings shall be shielded, regreasable, vacuum degassed steel ball bearings, specially selected for electric motor service and long-life expectancy (B-10 MINIMUM).

B. Bearings shall be lubricated with a premium moisture resistant grease formulated to operate over a temperature range of -20 degrees F to +300 degrees F.

C. Bearing identification by AFBMA number shall be shown on motor nameplate.

2.5 ENCLOSURES

A. Construction shall be of rugged corrosion resistant metal including a one-piece frame, brackets, conduit box and fan shroud.

B. Fans shall be bi-directional and constructed of low inertia inert material.

2.6 CONDUIT BOXES

A. Conduit boxes are to be diagonally split, rotatable in 90 degree turns, gasketed cast iron construction with threaded conduit holes.

B. Ground lug suitable for grounding motor frame shall be furnished inside of conduit box.

C. A neoprene lead seal separator gasket shall be mounted between motor frame and conduit box to prevent entry of moisture and dust into the motor.

D. Conduit box size must meet or exceed minimum as shown in NEC Standards based on motor full load current.

2.7 HARDWARE

A. Corrosion-resistant cadmium plated grease plugs shall be provided for relubrication of bearings.

B. An external shaft flinger shall be provided on the shaft to prevent entrance of moisture or dust into the bearings.

C. All motors Frame 182T and larger shall have lifting eyebolts for lifting the entire motor.

D. An easy-to-read nameplate shall be provided on each motor and shall include at least the following information:
1. Horsepower
2. RPM
3. NEMA Design
4. Phase
5. Hertz
6. Service Factor
7. Ambient Temperature
8. Frame Size
9. Duty
10. Class of Insulation
11. Locked KVA Code
12. Full Load Amps
13. Model or Catalog Number
14. Bearing Identification
15. Guaranteed Minimum Efficiency
16. Nominal Efficiency
17. Voltage

2.8 MOTOR CONSTRUCTION

A. Motors shall be dynamically balanced to limits as indicated below:

Speed	Maximum Amplitude (Peak-to-Peak)
3500 & Above	.0010
1700 to 3499	.0015
Less than 1700	.0020

2.9 FINISH

A. All external surfaces shall be prime painted with red oxide zinc chromate primer to prevent corrosion.

B. The finish coat of paint shall be a full-gloss epoxy enamel paint. External finish shall protect against moisture and have superior heat resistance to withstand the effects of sunlight and outdoor weathering without chipping or cracking.

2.10 EFFICIENCY

A. Motors furnished shall meet or exceed the efficiency listed on the following Table.

HIGH EFFICIENCY MOTORS

HP	3600 RPM EFFICIENCY		1800 RPM EFFICIENCY		1200 RPM EFFICIENCY	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM	NOMINAL	MINIMUM
1	81.5	78.5	84.0	81.5	78.5	75.5
1.5	81.5	78.5	84.0	81.5	84.0	75.5
2	84.0	81.5	84.0	81.5	86.5	84.0
3	86.5	84.0	88.5	86.5	88.5	86.5
5	88.5	86.5	90.2	88.5	88.5	86.5
7.5	88.5	86.5	90.2	88.5	88.5	86.5
10	88.5	86.5	90.2	88.5	90.2	88.5
15	90.2	88.5	91.7	90.2	90.2	88.5
20	90.2	88.5	91.7	90.2	91.7	90.2
25	90.2	88.5	93.0	91.7	91.7	90.2
30	91.7	90.2	93.0	91.7	91.7	90.2
40	91.7	90.2	93.0	91.7	93.0	91.7
50	91.7	90.2	94.1	93.0	93.0	91.7
60	93.0	91.7	94.1	93.0	93.0	91.7
75	94.1	93.0	94.1	93.0	94.1	93.0
100	94.1	93.0	95.0	94.1	94.1	93.0
150	94.1	93.0	95.0	94.1	94.1	93.0
200	94.1	93.0	95.0	94.1	95.0	94.1
250	95.0	94.1	95.0	94.5	-	-

END OF SECTION

SECTION 22 05 23 VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. All valves except lubricated plug valves and butterfly valves shall be manufactured by Nibco, Hammond, Lunkenheimer, Kennedy, Stockham, Walworth, Powell, or Milwaukee.

B. Lubricated plug valves shall be as manufactured by Rockwell, Milwaukee, or Walworth.

C. Butterfly valves shall be as manufactured by W.C. Norris, Centerline, Nibco, Demco, Grinell, Milwaukee, or Keystone.

1.3 RELATED WORK IN OTHER SECTIONS

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 07 00	PIPING INSULATION
22 11 13	DOMESTIC WATER SYSTEMS
22 11 23	NATURAL GAS PIPING SYSTEMS
22 13 13	SOIL AND WASTE PIPING SYSTEMS
22 14 13	ROOF DRAINAGE SYSTEMS
23 05 19	PIPING SPECIALTIES
23 05 48	VIBRATION ISOLATION AND EXPANSION COMPENSATION

1.4 IDENTIFICATION OF VALVES

A. Each valve shall be provided with a stamped metal tag secured to the valve with metal chain. Tag shall indicate both the service and function of each valve. The Contractor shall furnish two prints of drawings showing floor plan for each floor with all valves accurately located and labeled. These drawings shall be neat and easily read.

PART 2 - PRODUCTS

2.1 VALVES

A. Heating water and domestic water: all domestic water system valves shall be lead free components.
   1. Gate Valves 2" and Under: Nibco No. T134, rising stem, ductile iron hand wheel, union bonnet, solid wedge disc, bronze body, Class 150 psi working pressure.
   2. Gate Valves 2-1/2" and Larger: Nibco No. F617-0, bronze trimmed, solid wedge disc, iron body, O.S. & Y., 125 psi working pressure.
   3. Swing Check 2" and Under: Nibco No. T433, swing type, Y-pattern, all bronze, renewable seat & disc, regrinding, 200 psi working pressure.
   4. Swing Check, 2-1/2" and Larger: Nibco No. F938-31, iron body, bolted bonnet, Class 150, bronze trimmed, check valves installed at discharge of pumps shall be non-slam type.
   5. Globe Valves 2" and under: Nibco No. T235, union bonnet, integral seat, Class 150 bronze body with renewable disc.
   6. Globe Valves, 2-1/2" and Larger: Nibco No. 718-B, bolted bonnet, cast iron body, 125 psi working pressure 0.S. & Y., pattern bronze trimmed.
   7. Gate Valves 3” and Under for Copper Pipe: Nibco No. S134, union bonnet, Class 150 bronze rising stem wedge disc.
   8. Globe Valves 2” Under for Copper Pipe: Nibco S-235, Class 150, bronze union bonnet, integral seat, renewable seat and disc.
   9. Angle Valves 2” and Under Copper Pipe: Nibco T335, Class 150, Union Bonnet, integral seat, renewable seat & disc.
   10. Angle Valves 2 1/2” and Larger: Nibco F8180-B, Class 125, bolted bonnet cast iron, renewable seat & disc., bronze trim.
   11. Check Valve for 3” and under for Copper Pipe: Nibco S-433, Y-pattern, swing type, all bronze, renewable seat & disc.

12. Manual Balancing Valves:
    a. 2” and Under: Nibco T-585-70 ball valve or Milwaukee Butterball butterfly valve with calibrated flow set handle.
    b. 2-1/2” and Larger: W.C. Norris butterfly valves with lever with infinite throttling position as specified below.
13. Circuit Balancing Valves: Balance Valves shall be “Circuit Setter” balance valves as manufactured by Bell & Gossett.
14. Automatic Balancing Valves: Shall be spring loaded, variable orifice type capable of maintaining present flow within 5% over an operating pressure differential of at least 14 times the minimum valve pressure requirement. Maximum controlled pressure differential shall be at least 75% of the system pump head. Valve shall be Griswold Automatic Flow Control Valve or approved equal. At Contractor’s option, automatic flow control valves may be used in 2” size and above in lieu of manual balancing valves.
15. Butterfly Valves: Lug type butterfly valves, ductile iron or cast iron body, bronze blade, stainless steel shaft and with EPT liner for tight shutoff up to 150 psi, bonded seat. Valves to be suitable for mounting between flanges, with lugs drilled and tapped so that pipeline can be disconnected with the valve still holding pressure. Valves 3” and smaller to have lever operators with infinite throttling positions. Valves 4” and larger to have worm gear and hand wheel manual operators. Butterfly valves may be used in lieu of gate valves for water service 2” and larger. Liner shall be suitable for -30 F to + 275 F.
16. Ball Valves:
    a. 1/2” to 2”: Nibco No. T-585-70, two piece body, bronze, screwed ends, Teflon seats, straight through flow design.
17. Lubricated Plug Valves: Rockwell Mfg. Co. “Permaturn” lubricated plug valves Fig. No. 143. Provide valve handle for each valve. Valves shall have tapered plugs with thermally bonded lubricated film.
18. Water Pressure Relief Valves for makeup to heating and cooling systems, and relief for heating and cooling system, Bell & Gossett No. 1170 unless otherwise noted.
19. Relief Valves for hot water generators and heating converters. ASME labled temperature and pressure relief valves shall be installed on the hot water generator. Pressure relief valve shall be installed on the converter set for 30 psi. Valves shall be sized for the full heating capacity. Discharge from valves shall be piped to the nearest floor drain.
20. Drain Valves: Nibco No. T134, 3” and smaller.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All valves shall be installed in locations which will allow easy operation and facilitate maintenance.

B. Gate and globe valves shall be installed with stems up.

C. System balancing valves shall be installed where shown or required to balance waterflows to all system components. In general balancing valves shall be provided at the following locations:
    1. Each pump discharge, lubricated plug valve.
    2. Each main branch circuit, circuit balancing valve.
    3. At each water coil, circuit balance valve.

END OF SECTION

SECTION 22 07 00 PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and Install:
   1. Piping insulation
   2. Jackets and accessories

1.2 RELATED DOCUMENTS:

A. The General Provisions of the Contract, including General and Special Conditions and the General Requirements apply to the work specified in this section.

B. Insulation furnished under this specification shall comply with all requirements of the State Energy Code and the recommendations of the latest edition of ASHRAE 90.1 and these specifications. The more stringent of these shall be the standard for the work provided under these specifications.

C. The work included under this specification consists of furnishing all labor, accessories, equipment, and materials necessary for installation of all piping, and mechanical equipment insulation systems. This includes but is not limited to:
   1. Thermal Insulation
      a. Domestic hot water piping
      b. Heating water piping
      c. Refrigerant piping
   2. Condensation Prevention Insulation
      a. Domestic cold water piping
      b. Roof drain and overflow piping and roof drains

1.3 RELATED WORK IN OTHER SECTIONS

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
23 05 00	GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS

1.4 REFERENCES

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Guarded Hot Plate Apparatus.

C. ASTM C195 - Mineral Fiber Thermal Insulation Cement.

D. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

E. ASTM C518 - Test Methods for Steady-State Heat Flux, Heat Flow Meter Apparatus.

F. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.

G. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

H. All preformed Fiberglass pipe insulation with factory applied jackets shall meet the following standards:
   ASTM E84 - Surface Burning Characteristics of Building Materials
   ASTM E96 – Jacket Permeance
   ASTM C335-Steady-State Heat Transfer Properties of Horizontal Pipe Insulation
   ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

ASTM C547 - Mineral Fiber Preformed Pipe Insulation
ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
ASTM C795 – Thermal Insulation for use in Contact with Austenitic Stainless Steel
ASTM C1136 – Flexible Low Permeance Vapor Retarders for Thermal Insulation: Types I-IV.
NRC 1.36 – Nuclear Regulatory Commission Guide 1.36 Non Metallic Thermal Insulation
NFPA 90A – Air Conditioning and Ventilating Systems
NFPA 255 – Test of Surface Burning Characteristics of Building Materials
UL 723 – Composite Surface Burning Characteristic
CAN/ULC S102-M – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
MIL-I – 22344D – Insulation, Pipe, Thermal, Fibrous Glass
MIL-I – 24244C (Ships)
USCG 164.109 – Non Combustible Materials
New York City MEA
GreenGuard Certified for Indoor Air Quality
GreenGuard Certified for Children and Schools

1.5 DEFINITIONS

A. Exposed Location: Exposed in mechanical rooms, rooms with finished walls or ceilings, and pipe chase between toilet rooms and equipment rooms.

B. Concealed Location: Located in furred spaces, attics, crawl spaces, above suspended ceilings in finished or unfinished rooms, or all other locations not exposed to view.

C. Cold Piping: Shall include domestic water and other piping with surface temperatures less than 70°F.

D. Hot Piping: Domestic hot water, supply and return and other piping with surface temperatures greater than 105°F.

E. Exterior Locations: All locations exposed, unexposed above grade or below grade beyond the building floor, wall or roof line of the structure or building.

F. Location and Insulation Requirements:
1. Cold Water, including Non-potable Water (NPW): Insulate as follows:
   a. All piping above ceilings and in walls.
   b. Entire system except for stubouts to fixtures.
2. Domestic Hot: Insulate as follows:
   a. Entire system except for stubouts to fixtures.
3. Heating Water Supply and Return:
   a. All piping above ceilings, drops in wall and in mechanical rooms.
4. Roof drains and over flows:
   a. All piping in building, ceilings, walls
5. K Factors: All K Factors shown in this Specification are expressed in BTU-in/hr.-ft^2-F.

1.6 SUBMITTALS

A. Comply with Section 220500 - General Plumbing Requirements.

B. Product Data: Provide product description, list of materials and thickness for each service and location.

C. Manufacturer's Installation Instructions: Indicate procedures, which ensures acceptable workmanship and installation standards will be achieved.

1.7 QUALITY ASSURANCE

A. Qualifications of Applicator: Company specializing in piping insulation application with five (5) years minimum experience.

B. Regulatory Requirements Fire Hazard Classification: Insulation shall have a composite (insulation, jacket or facing, and adhesive to secure jacket or facing) fire hazard rating as tested by ASTM E-84, NFPA 255, and UL 723 not to exceed 25 flame spread, 50 fuel contribution, and 50 smoke developed. Materials shall be labeled accordingly.

1.8 DELIVERY, STORAGE AND HANDLING

A. Compliance: Comply with Section 230500. Deliver materials to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness and store in a warm, dry location.

1.9 PROJECT/SITE CONDITIONS

A. Storage Environment: Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation while in storage.

B. Environmental Requirements: Perform work at ambient and equipment temperatures as recommended by the insulation manufacturer.

C. Protection: Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Repair or replace any such insulation or covering damaged prior to final acceptance of work.

D. Application Surfaces: Surface shall be dry, free of dust, oil, construction residues or other foreign materials before insulation is applied. Piping joints shall be dry, leak free and tested before application of insulation occurs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Owens-Corning
   2. Knauf
   3. Johns Manville
   4. Industrial Insulation Group

2.2 MATERIALS

A. Glass Fiber:
   1. Insulation: ASTM C547; rigid molded, noncombustible.
      a. 'K' value: ASTM C335, 0.24 at 75 °F
         1) K values shall conform to the following at 75°F
            (a) Heating water to 250°F: .28
            (b) Heater water and Steam to 350°F or above: .32
            (c) Chilled water 40°F to 55°F: .24
            (d) Domestic water 105°F or greater: .24
      b. Minimum Service Temperature: -20°F
      c. Maximum Service Temperature: +450°F
      d. Maximum Moisture Absorption: 0.2 percent by volume
   2. Vapor Barrier Jacket:
      a. All Service Vapor Retarder Jacket
      b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
      c. Secure with self sealing longitudinal laps and butt strips.
      d. Alternate: Paper Free All Service Vapor Retarder Jacket

2.3 JACKETS

A. PVC Plastic
   1. Jacket: ASTM C921, One piece molded type fitting covers and sheet material, off white color.
      a. Minimum Service Temperature: -40°F
      b. Maximum Service Temperature: +150°F

c. Moisture Vapor Transmission: ASTM E96; 0.002 percent by volume
d. Maximum Flame Spread: ASTM E84: 25.
e. Maximum Smoke Developed: ASTM E84; 50
f. Thickness: 20 mil.
g. Connections: Brush on welding adhesive
2. Covering Adhesive Mastic: Compatible with insulation
3. Acceptable Manufacturers
a. Proto
b. Zeston
c. Speedline

B. Canvas Jacket; UL listed.
1. Fabric: ASTM C921, 6 oz/sq yd, plain weave cotton treated with dilute fire-retardant lagging adhesive.
2. Lagging Adhesive: Compatible with insulation.
3. Aluminum Jacket: ASTM B209.
a. Thickness: 20 mil inch sheet.
b. Finish: Smooth.
c. Joining: Longitudinal slip joints with 2-inch laps.
d. Fittings: 0.016-inch-thick die shaped covers with factory attached protective liners.
e. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum.

C. Aluminum Jacket: ASTM B209
1. Thickness: 0.016-inch sheet.
2. Finish: Smooth
3. Joining: Longitudinal slip joints and 2-inch laps.
4. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum.

D. Stainless Steel Jacket: Type 304 stainless steel.
1. Thickness: 0.016 inch
2. Finish: Smooth
3. Metal Jacket Bands: 3/8 inch wide; 0.016-inch-thick stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect work in conformance with Section 220500 - General Plumbing Requirements.

3.2 PREPARATION

A. Pipe Testing: Testing of piping shall be completed and leaks repaired prior to application of insulation. Surfaces shall be clean and dry before proceeding.

B. Installation: Install materials after piping has been tested and approved. See Section 220500 - General Plumbing Requirements.

C. Surface Cleaning: Clean surfaces for adhesives.

3.3 INSTALLATION

A. Pipe Insulation:
1. Manufacturer's Instructions: Install materials according to manufacturer's instructions.
2. Finished Surface Temperature: Insulation thickness shall conform to those recommended ASHRAE 90.1, latest edition, unless otherwise specified. Thickness of insulation shall be sufficient to keep surface temperatures below 115°F.
3. Continuity: Apply insulation tightly over clean, dry surfaces with sections or edges firmly butted together. Make insulation continuous through sleeves or openings in walls and floors.
4. Make insulation continuous at pipe hangers, trapezes, and other types of supports. Do not notch insulation to fit over hangers, trapezes, and other supports. Install shields at all supports.

5. Name Plates: Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
6. Supports: Finish insulation neatly at hangers, supports and other protrusions. Locate insulation or cover seams in least visible locations.
7. Inserts: Provide an insert, not less than 6-inches long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 2-inches diameter or larger, to prevent insulation from compressing at support points. Inserts shall be cork, hardwood or other heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used with field fabricated insulation value equal to insulation approved by the Project Engineer. Do not use calcium silicate inserts or other material that can absorb moisture on any below ambient piping system.
8. Enclosures: Do not insulate hot water heating pipe within radiation enclosures.
9. Flanges: On insulated piping without vapor barrier and piping conveying fluids 140°F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.
10. Equipment Fittings and Valve Coverings: Insulate all equipment, fittings, and valves. Terminate insulation neatly with insulating and finishing cement troweled on bevel.
11. Preformed Fittings Locations: All fittings and valves shall be insulated with preformed fiberglass for fittings, mitered sections of pipe insulation or fiberglass blanket insulation of equal thickness to the adjacent pipe insulation. Cover the fittings, valves, and insulation with preformed PVC jacket. Close jacket with stainless steel tacks and compatible adhesive.
12. Radiation Barrier: When insulating hot pipe fittings, a layer of kitchen-type aluminum foil shall be applied over the first fiber glass insert applied, making sure the aluminum foil is extended over the adjacent pipe insulation. A second fiber glass insert shall then be applied over the foil with a vapor seal at all the aluminum foil edges. Insulation thickness shall be such that the surface temperature shall not exceed 115°F.
13. Expansion Devices: On insulated piping with vapor barrier; insulate all equipment, fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
14. Fasteners: Avoid the use of staples on vapor barrier jackets. Seal vapor barrier penetrations with white vapor barrier finish and adhesive.
15. Adhesive Limitations: Apply adhesives to not exceed the coverage recommended by the manufacturer.
16. Wall, Floor and Ceiling Penetrations: Continue insulation with vapor barrier through penetrations including walls, floors, and ceilings.
17. Enclosure: All insulation ends shall be firmly butted and secured with minimum 3-inch-wide butt strips. Exposed end of pipe insulation shall be sealed with vapor barrier mastic.
18. Repairs: Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
19. Service Access: When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
20. A complete moisture and vapor seal shall be provided on cold surfaces where vapor barrier jackets or coatings are required. Anchors, hangers and other projections shall be insulated and vapor sealed to prevent condensation. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
21. Insulation shall be installed in a workmanlike manner by workmen regularly engaged in this type of work. Insulation shall not be applied until all surfaces are clean and dry and until inspection and release for insulation application.
    a. Do not notch insulation to fit around trapezes or wall-mounts fabricated from slotted metal framing (“unistrut or equal”), angle iron or other materials. Insulation shall be continuous across the support and an insulation shield shall be installed to prevent crushing the insulation. Pipe clamps shall be sized to fit around insulation and shield.
    b. Insulation may be notched or trimmed around riser clamps. Seal exposed insulation.

B. Jackets:
1. Indoor, Concealed Applications: Insulated pipes conveying fluids above ambient temperature shall have standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish fittings, joints, and valves with premolded PVC jackets secured with stainless steel tacks. The precut insulation shall be held in place by copper wire or hemp twine, and be removable without damage to the insulation or jacket. Leave surfaces clean and ready for painting.
2. Indoor, Concealed Applications: Insulated dual-temperature pipes or pipes conveying fluids below ambient temperature shall have vapor barrier jackets, factory-applied or field-applied. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe, and finish with premolded PVC jackets.

3. Indoor, Exposed Applications: Mechanical Equipment Rooms, all insulated piping to be finished with aluminum jacket secured with metal jacket bands.
4. Indoor, Exposed Applications: Same as Indoor, Concealed Applications except that in addition the insulation shall be covered with an aluminum jacket secured with metal jacket bands.
5. Exterior Applications: Same as Indoor, Exposed Applications plus connect with a modified S lock equal to Premetco “Loc-Jack” Z-Crimp, Factory or Field installed. All seams shall be sealed with silicone caulking and have seams oriented so that the jacketing will shed water & not tend to trap and enter rain water.

3.4 APPLICATION

A. Fittings and Valves Insulation:
   1. Premolded Fittings: All insulated pipe fittings shall be insulated with 20 mil PVC Zeston one piece premolded insulated fittings wherever possible. If Zeston fittings are not available for the use required, comply with the following paragraph #2. Insulate fittings with fiberglass tightly wrapped with copper wire or heavy hemp twine to within 1/4 inch of thickness of adjoining copper wire or insulation, finished with 1/4 inch of insulating cement troweled flush with pipe insulation. A tack coat of mastic vapor barrier Foster 60-25 or 26 to 1/16 inch thickness or equal shall be applied to fittings and valves. Apply 6 oz. fiberglass canvas jacket to build-up (not PVC) fitting band valve insulation. Cement laps thoroughly with Foster 81-42 or 30-36 adhesive.

B. Perm Rating Vapor Barrier Mastic Coatings:
   1. Perm rating not more than 0.25 when tested in accordance with ASTM E-96, Procedure A Fire Retardant.

C. Adhesives, Sealers, Facings, and Vapor Barrier Coatings:
   1. Compatible with materials to which applied, and shall not corrode, soften, or otherwise attach the pipe or insulation materials in either the wet or dry state. Use only adhesives, sealers, facings, and vapor barrier coatings recommended by the approved manufacturers of insulation materials.

3.5 SCHEDULE

Service	Pipe Size	Thickness
CW, HW, HWC	All sizes CW, 1/2 inch to 1 1/4 inch HW, HWC	1 inch
	1-1/2 inch and Larger HW, HWC	1-1/2 inch
NPW	All sizes	1 inch
HWS, HWR	All sizes	2 inch
RD & OF	All sizes	1 inch

END OF SECTION

SECTION 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The purpose of this section is to specify the Division 22 responsibilities and participation in the Commissioning Process and to conform to NM Energy Code requirements.

B. Work under this contract shall conform to requirements of Division 01, General Requirements, Conditions of the Contract, and Supplementary Conditions. This specification covers commissioning of plumbing systems which are part of this project.

C. Commissioning work shall be a team effort to ensure that all plumbing equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and document system performance. Commissioning shall coordinate system documentation, equipment start-up, control system calibration, testing and balancing, and verification and performance testing.

D. The Commissioning Team shall be made up of representatives from the Owner, Design Team, General Contractor (GC), manufacturers, and construction trades. The trades represented on the Commissioning Team shall include, but not be limited to: mechanical (including sheet metal and piping), Building Automation System, Test and Balance, Electrical, Plumbing and other specialty trades as necessary; controls, test and balance, and electrical. The lead person for each trade who will actually perform or supervise the work is to be designated as the representative to the Commissioning Team. Responsibility for various steps of the Commissioning Process shall be divided among the members of the Commissioning Team, as described in this section.

E. The Commissioning Authority (CxA) shall have responsibility for coordinating and directing each step of the Commissioning Process.

F. Plumbing system installation, start-up, testing, balancing, preparation of O&M manuals and operator training are the responsibility of the Division 22 Contractors, with coordination, observation, verification and commissioning the responsibility of the General Contractor per Division 01. The Division 01 Commissioning Process does not relieve Division 22 – Contractor from the obligations to complete all portions of work in a satisfactory and fully operational manner.

G. Refer to Division 01 for a full list of commissioning requirements. A few critical definitions are included below:
   1. Commissioning. A systematic process that provides documented confirmation that specific and interconnected fire and life safety systems function according to the intended design criteria set forth in the project documents and satisfy the owner's operational needs, including compliance requirements of any applicable laws, regulations, codes, and standards requiring fire and life safety systems.
   2. Commissioning Authority (CxA). The qualified person, company, or agency that plans, coordinates, and oversees the entire Cx process.
   3. Commissioning Plan. The document prepared for each project, which identifies the processes and procedures necessary for a successful Cx process.
   4. Commissioning Record. The complete set of commissioning documentation for the project, which is turned over to the owner at the end of the construction phase.
   5. Functional Testing. Tests performed to verify compliance with manufacturers' specifications, applicable codes and standards, and the project BOD and OPR.

1.2 RELATED SECTIONS

A. Division 01 Section 01 91 13 - General Commissioning Requirements

B. Division 23 Section 23 08 00 - Commissioning of HVAC Systems

C. Division 26 Section 26 08 00 - Commissioning of Electrical Systems

D. Division 27 Section 27 08 00 - Commissioning and Acceptance

E. Division 01, 21, 22, 23, 25, 26, and 27 sections contain requirements related to the commissioning process

1.3 ROLES AND RESPONSIBILITIES

A. Refer to Section 01 9113 for Commissioning Authority, Owner, Architect, and General Contractor roles and responsibilities.

B. Refer to Section 23 0800 for mechanical contractor roles and responsibilities.

C. Refer to Section 26 0800 for electrical contractor roles and responsibilities.

D. Refer to Section 27 0800 for communications contractor roles and responsibilities.

E. Design Team See Section 220500 - GENERAL PLUMBING REQUIREMENTS
1. Provide the Owners Project Requirements (OPR).
2. Provide documentation of initial design concepts and Design Intent based on Owner's program.
3. Provide plumbing system design parameters and obtain approval of Owner.
4. Prepare contract documents incorporating Commissioning Specification requirements and description of the electrical systems.
5. The Design Team shall specify and verify adequate maintenance accessibility for each piece of equipment in shop drawings and the actual installation.
6. Periodic inspections as part of the Design Team's contract with the Architect and/or Owner.
7. Review and approve submittals.
8. Participate in commissioning meetings.
9. Review Pre-functional Checklists and Functional Performance Test procedures submitted by the Commissioning Authority.
10. Prepare punch lists.
11. Review as-built records as required by contract documents. Issue a report noting deficiencies requiring correction to the Commissioning Authority.
12. Review and comment on final commissioning report

F. Plumbing Contractor
1. Include cost to complete commissioning requirements for plumbing systems in the contract price.
2. Include requirements for submittal data, O&M data, and training in each purchase order or subcontract written.
3. Ensure cooperation and participation of all subcontractors.
4. Ensure participation of major equipment manufacturers in appropriate training and testing activities.
5. Attend Construction Phase coordination meeting scheduled by the Commissioning Authority.
6. Conduct plumbing system orientation and inspection when equipment is set.
7. Respond to (in writing) and address items documented in the Contractor Commissioning Issues Log.
8. Notify the GC a minimum of two weeks in advance of system start-up and testing, so CxA may be on site to witness.
9. Notify the GC a minimum of two weeks in advance, of the time for start of the TAB work. Attend the initial TAB meeting for review of the TAB procedures.
10. Submit copies of all test results to the CxA.
11. Complete Pre-Functional Checklists for all equipment.
    a. If no other system is agreed upon by Commissioning Team, Plumbing Contractor shall be responsible for completion of Pre-Functional Checklists for all equipment for which it issued a purchase order.
    b. Plumbing Contractor shall coordinate completion of Pre-Functional Checklists with all other contractors that have made connections to equipment for which it issued a purchase order.
    c. Remedy any deficiencies identified in Pre-Functional Checklists and notify CxA in writing that deficiencies have been addressed.
12. Assist the Commissioning Authority in all Pre-Functional Checklist verifications and Functional Performance Tests.
13. Prepare preliminary schedule for plumbing system orientation and inspections, O&M manual submission, training sessions, pipe system testing, flushing and cleaning, equipment start up, TAB, and task completion for use by the GC and Commissioning Authority. Update schedule as appropriate throughout the construction period.
14. Conduct plumbing system orientation and inspection when equipment is set in place.
15. Keep drawings updated as changes in the field are made, and review with the GC and Commissioning Authority.
16. Gather O&M data on all equipment, and assemble in binders as required by the Commissioning Specification. Submit to GC for review prior to the completion of construction.
17. Participate in, and schedule vendors and Contractors to participate in the training sessions as set up by the GC.
18. Provide written notification to the General Contractor and Commissioning Authority that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-systems are functioning as required.
    a. Domestic cold and hot water equipment and systems including all pumps, meters, backflow preventers, softeners, thermostatic mixing valves, and all Division 22 equipment.
    b. Specialty plumbing systems, medical gas systems and certification, if applicable.

c. Storm water system. d. Building automation systems are functioning to relay plumbing and medical gas equipment alarms where required.
19. Submit training syllabus for approval to Commissioning Authority.
20. Participate in, and schedule vendors and Contractors to participate in the training sessions as set up by the GC. Provide site-specific training information on digital media/electronic format (flash drive, CD, DVD). If training is videotaped, provide on digital media/electronic format (flash drive, CD, DVD).
21. Provide a complete set of as-built records to the GC. Hard Copy and Electronic Format (Flash Drive, CD, DVD, email, Dropbox, etc….) are required.

G. Test, Adjust, and Balance Contractor
1. Include cost for commissioning requirements in the contract price.
2. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
3. Submit the TAB procedures to the GC for review and acceptance.
4. Attend the TAB review meeting scheduled by the GC. Be prepared to discuss the procedures that shall be followed in testing, adjusting, and balancing the plumbing system.
5. Participate in training sessions as scheduled by the GC.
6. At the completion of the TAB work, and submittal of final TAB report, notify the Plumbing Contractor.
7. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the Commissioning Authority for verification or diagnostic purposes.

H. Equipment Manufacturers and Miscellaneous Contractors
1. Include cost for commissioning requirements in the contract price.
2. Provide submittals, and appropriate O&M manual section(s).
3. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
4. Participate in training sessions as scheduled by the GC.
5. Demonstrate performance of equipment as applicable

1.4 SCOPE OF WORK

A. Commissioning work of Division 22 shall include, but not be limited to:
1. Testing and start-up of the equipment.
2. Logging in and checking the WCxS at least once a week for outstanding items.
3. Completion of Pre-Functional Checklists on the WCxS.
4. Testing, adjusting, and balancing of domestic hot water systems.
5. Cooperation with the Commissioning Authority. Include a statement certifying that all components in contact with positive pressure gases comply with the requirements of CGA-G4.1.
6. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial testing.
7. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the Commissioning Process.
8. Providing operation and maintenance manuals and as-built drawings to the Commissioning Authority for verification.
9. Providing training and demonstrations for the systems specified in this Division.

B. The work included in the Commissioning Process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be evaluated:
1. Domestic Water Heaters and associated recirculation pumps and mixing valves
2. Vacuum System
3. Automatic Sprinkler System
4. Sump Pumps and Elevator Pump
5. R/O or special water systems
6. Trap primers.
7. Emergency eyewash system including mixing valve
8. Compressed Air System
9. Acid Wate System
10. Oxygen System

C. Timely and accurate documentation is essential for the Commissioning Process to be effective. Documentation required as part of the Commissioning Process shall include but not be limited to:
1. Commissioning Process Reports, which may include the following:
a. Commissioning Field Reports
b. Design Team Issues Log
c. Contractor Commissioning Issues Log
d. Meeting Minutes

2. Pre-start, and start-up procedures
3. Pre-Functional Checklists
4. Functional Performance Tests
5. Training agenda and materials
6. As-built records
7. Final commissioning report
8. Operation and maintenance (O&M) manuals

D. Detailed testing may be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. All tests shall be witnessed by the Commissioning Authority. The following testing is required as part of the Commissioning process:
1. Pre-Functional Checklists (PFC) are comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract documents. Verification is completed by the Division 22, 23 and 26 contractors and documented using Pre-Functional Checklists.
2. Functional Performance Tests (FPT) shall determine if the plumbing system is operating in accordance with the design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.

E. Comprehensive training of O&M personnel shall be performed by the Plumbing Contractor, and where appropriate, by other sub-contractors, and vendors prior to turnover of building to the owner. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems.

1.5 DOCUMENTATION

A. The Commissioning Authority shall oversee and maintain the development of the document process. The GC shall facilitate project documentation through the web-based commissioning software. The commissioning documentation shall include, but not be limited to, the following:
1. Commissioning Plan
2. Commissioning Schedule
3. Document Request Log
4. Commissioning RFIs
5. Commissioning Field Reports on the WCxS
6. Design Team Issues Log on the WCxS
7. Contractor Commissioning Issues Log on the WCxS
8. Pre-Functional Checklists on the WCxS
9. Functional Performance Tests on the WCxS
10. See 01 91 13 for additional information on the commissioning documentation.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. The appropriate Contractor(s) shall furnish all special tools and equipment required for testing during the commissioning process. A list of all tools and equipment to be used during commissioning shall be submitted to the Commissioning Authority for approval. The owner shall furnish necessary utilities for the Commissioning Process.

2.2 TEST EQUIPMENT – PROPRIETARY

A. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the Commissioning Process as needed. Proprietary test equipment (and software) shall become the property of the owner upon completion of the Commissioning Process.

PART 3 – EXECUTION

3.1 GENERAL

A. A pre-construction meeting of all Commissioning Team members shall be held at a time and place designated by the owner. The purpose shall be to familiarize all parties with the Commissioning Process, and to ensure that the responsibilities of each party are clearly understood.

B. The Contractor shall complete all phases of work so the systems can be started, tested, balanced, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials,

pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.

C. A Commissioning Plan shall be developed by the Commissioning Authority. The Contractor shall assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If contractor-initiated system changes have been made that alter the Commissioning Process, the Commissioning Authority shall notify the Owner.

D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Division 22 contractor. Start of acceptance procedures before system completion does not relieve the contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

A. The Contractor shall provide skilled technicians to start-up and debug all systems within Division 22. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the Commissioning Authority and coordinated by the contractor. Contractor shall ensure that the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

B. System performance problems and discrepancies may require additional technician time, Commissioning Authority time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.

C. The Commissioning Authority reserves the right to question the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians shall include expert knowledge relative to the specific equipment involved and a willingness to work with the Commissioning Authority. Contractor shall provide adequate documentation and tools to start up and test the equipment, system, and/or sub-system.

3.3 DEFICIENCY RESOLUTION

A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the Owner, with input from the contractor, equipment manufacturer, and Commissioning Authority. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Owner shall make final determination over any additional required work to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit the completion of the Commissioning Process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the Commissioning Process, the Commissioning Authority shall notify the Owner, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner shall be the contractor's responsibility.

C. The Owner's contract with the Commissioning Authority includes up to two Functional Performance Tests of each piece of equipment or system included in the commissioning scope. Commissioning Authority time and expenses required for retests beyond two, if required, due to incomplete installation or otherwise, will be paid by the Owner and reimbursed by the contractor.

3.4 ADDITIONAL COMMISSIONING

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The contractor(s), manufacturers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their contractual obligations.

3.5 CONSTRUCTION PHASE OBSERVATION

A. Scope of Construction Phase Observation
   1. The Commissioning Authority will conduct periodic observations during the Construction Phase to monitor progress and compliance with the design intent and contract documents. It is the responsibility

of the contractor to address the issues noted on the web-based commissioning application and notify Commissioning Authority of completion.
2. Commissioning Authority observations will coincide with Design Team observations and are not intended to take the place of this work.

B. Documentation and Reporting
1. Issues identified by the Commissioning Authority during Construction Phase will be documented using the web-based commissioning application and distributed to Commissioning Team members.
2. Progress during the Construction Phase will also be documented by the Commissioning Authority using Commissioning Process Reports.

3.6 ACCEPTANCE PROCEDURES

A. Pre-Functional Checklists
1. Pre-Functional Checklist Scope
a. Tests and verifications included in the Pre-Functional Checklists shall determine if all components, equipment, systems, and interfaces between systems are installed and are ready to operate in accordance with contract documents.
2. Pre-Functional Checklist Roles and Responsibilities
a. The Commissioning Authority shall be responsible for creating the Checklists, which will be completed by the installing contractors and then verified (via spot checking and Functional Performance Testing). Participating contractors, manufacturers, etc. shall include all costs to do the work involved in these tests in their proposals. The following is a list of tasks and supporting information that shall be required:
b. The Plumbing Contractor shall provide the services of a technician(s) who is (are) familiar with the construction and operation of the applicable system. Provide access to the contract plans, shop drawings, and equipment cut sheets of all installed equipment.
3. Documentation and Reporting Requirements
a. Pre-Functional Checklists shall be provided for each component, piece of equipment, system, and sub-system, including all interfaces, interlocks, etc. Each item to be tested shall have a different entry line with space provided for comments. The checklists will include spaces for each party to sign off on.
b. Completed checklists shall be submitted to the Commissioning Authority for acceptance and inclusion in the commissioning report.
4. Acceptance of Pre-Functional Checklists
a. The Commissioning Authority will select, at random, 10 percent of the checklists for verification.
b. If 10 percent or more of the checklists are found to be inaccurate for each system or equipment type, all of the checklists for that system or equipment type will be rejected. Complete, accurate checklists will need to be resubmitted.

B. Test, Adjust, and Balance Verification
1. The Commissioning Authority shall select, at random, 25 percent of the report data for verification.
2. The TAB contractor shall be given sufficient advance notice of the date of field verification. However, they shall not be informed in advance of the data points to be verified.
3. Failure of an item is defined as:
a. For all readings other than sound, a deviation of more than 10 percent.
b. For sound pressure readings, a deviation of 3 decibels. (Note: variations in background noise must be considered).
4. A failure of more than 10 percent of the selected items shall result in the rejection of the final TAB report.

C. Functional Performance Testing
1. Scope of Functional Performance Testing
a. Functional Performance Tests shall determine if equipment, system, and/or subsystem is operating in accordance with the final design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions. The following is a list of test examples:
1) Determine capability of the sewage ejector to evacuate sewage at the required rate of flow.
2) Determine capacity of domestic hot water system to deliver hot water at the design temperature.
3) Determine the ability of the sump pumps to detect and properly react to all required alarms.
2. Functional Performance Test Report
a. Detailed procedures for each series of tests will be developed by the Commissioning Authority for review and acceptance by the GC and Owner. The procedures shall include samples of the data sheets that will be part of the reports.

3. Participants in Functional Performance Tests
   a. Participants in the Functional Performance Tests shall be the same as those listed in the Pre-Functional Checklists.
4. Functional Performance Test Procedures
   a. The Commissioning Authority shall supervise and direct all Functional Performance Tests.
      1) Set the system equipment (i.e., water heater, pumps, ejectors, etc.) into the operating mode to be tested (i.e., normal shut-down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
      2) The Commissioning Authority shall inspect and verify the position of each device and interlock identified in the test procedure. Each item shall be signed off as acceptable (yes) or failed (no).
      3) This test shall be repeated for each operating cycle that applies to the plumbing system being tested.
      4) Operating checks shall include all safety cutouts, alarms, and interlocks with smoke control and life safety systems during all modes of operation of the plumbing system.
      5) If during a test an operating deficiency is observed, appropriate comments will be added to the Test Procedure form and the Issues Log.
      6) Confirmation of the TAB results shall be verified utilizing the Building Automation System. This shall include, but not be limited to, the following:
         (a) Verify domestic hot water recirculation balancing.
      7) Verification of the proper responses of BAS system controllers and sensors shall be as follows:
         (a) For each controller or sensor, record the indicated BAS system reading, and the test instrument reading.
         (b) If the initial test indicates that the test reading is outside of the control range of the installed device, the calibration of the installed device shall be checked and adjusted as required. The deficient device shall be re-tested and the results recorded on the Functional Performance Test form.
   b. If deficiencies are identified during Functional Performance Testing, the General Contractor will be notified, and action taken to remedy the deficiency. The final Functional Test Procedure forms will be reviewed by the Commissioning Authority to determine if testing is complete and the system is functioning in accordance with the contract documents.
5. Documentation and Reporting Requirements
   a. All measured data, data sheets, and a comprehensive summary, describing the operation of the plumbing system at the time of testing shall be submitted to the Commissioning Authority.
   b. Data sheets used in verification of the proper operation of the control system shall include each controller to be verified, the system it serves, the service it provides, and its location. For each controller, provide space for recording the readout of the controller, the reading at the controller's sensor(s), and any comments.
   c. A preliminary Functional Performance Test report shall be prepared by the Commissioning Authority and submitted to the Design Team for review. Any identified deficiencies need to be evaluated by the Design Team and General Contractor to determine if they are part of the contractor's or sub-contractor's contractual obligations. Construction deficiencies shall be corrected by the responsible contractor(s), and the specific Functional Performance Test repeated.
   d. If it is determined that the plumbing system is constructed in accordance with the contract documents, and the performance deficiencies are not part of the contract documents, the Owner must decide whether any required modifications needed to bring the performance of the plumbing system up to the finalized design intent shall be implemented, or if the test shall be accepted as submitted. If corrective work is performed, the owner shall determine if a portion or all required Functional Performance Tests should be repeated, and a revised report submitted.

3.7 SYSTEM MANUAL

A. The Systems Manual shall be submitted in paper and/or electronic format and shall contain the following major sections:
   1. System Descriptions:
      a. Each major system shall be described, typewritten, in general terms, including major components, interconnections, theory of operation, theory of controls, unusual features and major safety precautions. This information should correlate with information provided in the manufacturers' instructions book. This section shall include, but not be limited to, the following data:
         1) Detailed description of each system and each of its components showing piping, valves, controls, and other components, with diagrams and illustrations where applicable.
         2) Wiring and control diagrams with data to explain detailed operation and control of each component.
         3) Control sequences describing start-up, all modes of operation, and shut down.
         4) Corrected shop drawings.
         5) Approved product data including all performance curves and rating data.
         6) Copies of approved certifications and laboratory or factory test reports (where applicable).
         7) Copies of warranties.

b. System diagrams, described in the following section, shall be incorporated in the appropriate systems descriptions. These should be reduced in size or folded to usefully fit into the manual.

2. Operating Instructions:
   a. Condensed, typewritten, suitable for posting, instructions shall be provided for each major piece of equipment. Where more than one (1) common unit is installed, one instruction is adequate. The instructions shall provide procedures for.
      1) Starting up the equipment/system
      2) Shutting down the equipment/system
      3) Operating the equipment in emergency or unusual conditions
      4) Safety precautions
      5) Trouble shooting suggestions
      6) Other pertinent data applicable to the operation of particular systems or equipment
   b. The instructions shall be suitable for posting adjacent to the equipment concerned.
   c. The contractor shall provide instructions for (at minimum):
      1) Booster Pumps
      2) Circulating Pumps
      3) Domestic hot water heaters
      4) Thermostatic mixing valves
      5) Sump pumps
      6) Vacuum System
      7) Compressed Air System
      8) Oxygen System
3. Ongoing and Preventive Maintenance:
   a. Condensed, typewritten procedures for recommended ongoing and preventive maintenance actions shall be provided for each category of equipment/system listed above. This information shall include, but not be limited to the following
      1) Maintenance and overhaul instructions.
      2) Lubricating schedule including type, grade, temperature, and frequency range.
      3) Parts list, including source of supply and recommended spare parts.
      4) Name, address, and 24-hour telephone number of each subcontractor who installed equipment and systems, and local representative for each type of system.
      5) Other pertinent data applicable to the maintenance of particular systems or equipment.
   b. These recommended preventive maintenance actions shall be categorized by the following recommended frequencies:
      1) Weekly
      2) Monthly
      3) Quarterly
      4) Semi Annual
      5) Annual
      6) Other

B. Posted Operating Instructions and Diagrams:
   1. Operating Instructions:
      a. Copies of operating instructions provided in the Systems Manual shall be posted in the near vicinity of each piece of applicable equipment. The instructions shall be mounted neatly in frames under Plexiglas, where they can be easily read by operating personnel. Instructions mounted outdoors shall be suitably protected from weather.

3.8 SYSTEMS TRAINING

A. The Plumbing Contractor, and appropriate sub-contractors, shall provide comprehensive systems instruction on building systems prior to delivery. The instruction shall include classroom instruction delivered by competent instructors based upon the contents of the Systems Manual. Emphasis shall be placed upon overall systems diagrams and descriptions, and how system components interact. The classroom instruction shall also include detailed equipment instruction by qualified manufacturer's representatives for which operating instructions are provided. The manufacturer's representative training shall emphasize operating instructions and preventive maintenance as described in the Systems Manual. At a minimum, the training sessions shall cover the following items:
   1. Types of installed systems
   2. Theory of operation.
      a. Design intent
      b. Emergency conditions and procedures
      c. Comfort conditions
      d. Energy efficiency
      e. Other issues important to facility operation

3. System operations
4. Use of control system
    a. Sequence of operation
    b. Problem indicators
    c. Diagnostics
    d. Corrective actions
5. Service, maintenance, diagnostics, and repair
6. Use of reports and logs
7. Troubleshooting, investigation of malfunctions, and determining reasons for the problem.

B. Each classroom training period shall be followed by an inspection, explanation, and demonstration of the system by the instructors. The applicable equipment shall be demonstrated including system startup and shutdown, with the exception of sprinkler systems.

C. The contractor shall be responsible for organizing, arranging, and delivering this instruction in an efficient and effective manner on a schedule agreeable to the Owner.

D. The contractor shall provide, at or before substantial completion, a proposed agenda and schedule of the above training for approval by the Commissioning Authority and the Owner.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 22 10 00 PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 SCOPE

A. This section of the specifications encompasses the basic materials and methods of the various piping systems covered in Division 25.

B. Standards: The latest edition of each standard referenced shall be used to determine compliance.

1.3 RELATED WORK IN OTHER SECTIONS

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 05 23	VALVES
22 07 00	PIPING INSULATION
22 11 13	DOMESTIC WATER SYSTEMS
22 11 23	NATURAL GAS PIPING SYSTEMS
22 13 13	SOIL AND WASTE PIPING SYSTEMS
22 14 13	ROOF DRAINAGE SYSTEMS
22 15 00	COMPRESSED AIR PIPING SYSTEMS
23 05 19	PIPING SPECIALTIES
23 05 48	VIBRATION ISOLATION AND EXPANSION COMPENSATION
23 21 13	HYDRONIC PIPING SYSTEMS

1.4 IDENTIFICATION OF PIPING

A. All accessible piping shall be labeled at not more than 10 ft. intervals with labels indicating the service and direction of flow. Pipe labels shall be self-adhesive labels, all-temperature Perma-Code pipe markers No. B-500, manufactured by the W.H. Brady Company. The background color code for all markers shall conform to the American National Standard A13.1 - 1975 "Scheme for the Identification of Piping Systems."

B. The color red shall be for the exclusive use on fire protection service piping and sprinkler piping per OSHA regulations (CFR 1910.144).

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS

A. Exterior Water Distribution
   1. Copper: Type K hard, seamless copper tube conforming to ASTM B88 with silver brazed joint per ASTM B260 Class BAg-1 with wrought copper fittings per ANSI B16-22.
   2. Ductile Iron: ANSI A21.51, minimum working pressure 200 psi. Cement mortar lined per ANSI A21.4. Mechanical joint fitting per AWWA C110 or push-on fittings per AWWA C110 and ANSI A21.11. Fittings shall be cement lined per ANSI 21.4, standard thickness.

B. Domestic water system
   1. Above grade:
      a. Copper: Shall be Type K soft drawn, or Type L hard drawn, seamless copper tubing conforming to ASTM B88, with wrought copper and bronze solder joint pressure fittings conforming to ANSI B16.22.
   2. Underground:
      a. Copper: Type K hard, seamless copper tubing conforming to ASTM B88 with silver brazed joints (ASTM B-260 Class BAg-1) with wrought copper fittings per ANSI B16.22.

C. Soil and waste system
   1. Above ground:
      a. Cast Iron: Shall be cast iron hub and spigot soil pipe or hubless cast iron pipe and fittings, (No-Hub Couplings shall conform to CISPI Standard 310 & ASTM A1277 or latest edition) conforming to ASTM A74 (latest edition) and/or Cast Iron Soil Pipe Institute (CISPI) CS-888 and shall be marked

with the collective trademark of the Cast Iron Soil Pipe Institute. The hub and spigot pipe shall use compression gasket joints per ASTM C564 & ASTM 1563.

2. Underground inside building:
   a. Cast Iron: Shall be cast iron hub and spigot soil pipe or hubless cast iron pipe and fittings, (No-Hub Couplings shall conform to CISPI Standard 310 & ASTM A1277 or latest edition) conforming to ASTM A74 (latest edition) and/or Cast Iron Soil Pipe Institute (CISPI) CS888 and shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. The hub and spigot pipe shall use compression gasket joints per ASTM C564 & ASTM 1563.
3. Underground outside buildings:
   a. Under traffic areas and parking lots: Shall be cast iron hub and spigot soil pipe conforming to ASTM A74 and Cast Iron Institute CISPI 301.
   b. All other areas: Piping shall be polyvinylchloride (schedule 40 for size 4" and smaller, SDR-35 for sizes 6" and larger), exterior sewer pipe (PVC) ASTM D3034 with gaskets per ASTM D1869.
   c. Risers and base fittings for grade cleanouts shall be extra heavy cast iron pipe and fittings with compression joints per ASTM C564 & ASTM-1563.

D. Sanitary vent system
1. Vent piping 2" and smaller in diameter may be schedule 40 galvanized steel pipe conforming to ASTM A53 with 150-pound galvanized malleable iron screwed fittings conforming with ANSI B16.3. Vent piping larger than 2" shall be cast iron as specified for interior soil and waste.

E. Refrigeration piping system
1. Copper: Shall be "ACR" Type L hard drawn, seamless copper tubing conforming to ASTM B280, with wrought copper and bronze solder joint pressure fittings conforming to ANSI B16.22.

F. Roof drain system
1. The roof drain system shall be the same as the soil and waste system except that for drains 2" and smaller in diameter, Schedule 40 galvanized steel pipe conforming to ASTM A53 with 150-pound galvanized malleable iron screwed fittings conforming with ANSI B16.3, may be used.

G. Heating systems
1. Copper: Shall be Type K soft drawn, or Type L hard drawn, seamless copper tubing conforming to ASTM B88, with wrought copper and bronze solder joint pressure fittings conforming to ANSI B16.22.
2. Galvanized steel: Shall be schedule 40, galvanized steel pipe conforming to ASTM A53 with 150-pound galvanized malleable iron screwed fittings conforming with ANSI B16.3.
3. Black steel: Shall be Schedule 40, black steel pipe conforming to ASTM A53. Fittings 2" and smaller shall be 250-pound malleable iron screwed fittings conforming with ANSI A197. Fittings 2 1/2" and larger shall be scheduled 40 weld fittings per ASTM A234. Flanges shall be 150-pound slip-on or wild neck types, flat faced, per ASTM A181, Grade 1.

H. Natural gas piping system
1. Black steel: Above grade piping shall be Schedule 40, black steel pipe conforming to ASTM A53, with 150-pound malleable iron screwed fittings conforming with ANSI B16.3. or seamless carbon steel weld fittings conform to ASTM A234.
2. Underground piping shall be schedule 40 black steel pipe conforming to ASTM A53 machine wrapped with Scotchwrap PVC tape using 50% overlap. Fittings and joints shall be double wrapped to a minimum 6 inches beyond the fitting. Pipe shall be primed prior to wrapping per manufacturer's recommendations.

I. Compressed air piping systems
1. Copper: Shall be Type L hard drawn, seamless copper tubing conforming to ASTM B88, with wrought copper, fittings or bronze solder joint pressure fittings conforming to ANSI B16.22-63.

2.2 JOINTS

A. Copper:
1. Silver brazed joints shall use brazing material containing approximately 45% silver, 15% zinc, 25% cadmium and 15% copper. Joints shall conform to ASTM B260 Class BAg-1. Approved materials include Mueller #122, Lucas Milhaupt "Easy Flo45" and United Wire and Supply "Sil-Bond 45".

B. Cast Iron:
1. Neoprene Rubber gaskets for hub and spigot piping per ASTM C564.
2. No hub joints shall consist of couplings that conform to CISPI 301.

C. Ductile Iron: Joints shall be of the stuffing box type per ANSI 21.11 as modified by ANSI 21.51 or push-on type per ANSI 21.51. Rubber gaskets and lubricant shall be per ANSI 21.11.

D. Black Steel:
   1. Screwed joints shall be made with no more than three threads showing using teflon tape or teflon joint sealing compound.
   2. Welded joints shall be fusion welded to full metal depth with width at least 2 1/2 times the depth of the metal being joined.

E. Galvanized Steel:
   1. Screwed joints shall be made with no more than three threads showing using teflon tape or teflon joint sealing compound.

F. Bell and spigot joints shall conform to AWWA C200 with rubber gaskets.

G. Bonded joints shall have metallic bond including joints made with flexible couplings, caulking or rubber gaskets. Metallic bond shall be of ferrous material to effect continuous conductivity. Bond wire shall be type RHW-USE, size 1/0 neoprene gasketed copper conductor. Bond shall be thermal weld type.

H. Insulating joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe. Insulating joints shall consist of a sandwich type flange insulating gasket of the dielectric type, insulating washers and insulating sleeves for flange bolts. Gaskets shall be full faced. Bolt insulating sleeves shall be full length. Units shall be of a construction to prevent metal to metal contact of dissimilar piping materials.

2.3 FLOOR, WALL, AND CEILING PLATES

A. Where exposed pipes pass through finished floors, finished walls, or finished ceilings, they shall be fitted with chromium plated spun brass flanges or flanges to match the type of pipe or pipe finish used. Plates shall be large enough to completely close the hole around the pipe and shall be not less than 1-1/2" or more than 2-1/2" larger than the diameter of the pipes. All plates shall be securely held in place.

2.4 UNIONS

A. Piping 2-1/2" and larger to have bolted flange unions with gaskets of material suitable for the specified service. Ground joint unions with brass to iron seats shall be used in piping 2" and smaller. Unions shall be installed at all valves and equipment connections.

B. Insulating Unions: See Specification Section 230519.

2.5 HANGERS AND ANCHORS

A. To prevent galvanic action between copper pipe and a dissimilar metal, copper pipe shall be isolated to prevent the pipe from contacting the dissimilar metal. This may be accomplished by mounting the pipe in an isolation fitting, or by wrapping the pipe with a 20-mil thickness of UPC-rated isolation tape. The 20-mil thickness can be accomplished by using a single wrap of 20-mil tape or by using 10-mil tape with a 50% overlap.

B. Copper pipe does not need to be isolated from copper plated pipe hangers that are suspended from hanger rods.

C. Copper pipe mounted on slotted metal framing (“unistrut or equal”), angle iron, or other dissimilar metal support shall be isolated as described above, even if pipe clamps used are copper plated. Painted, epoxy or powder-coated finishes on the metal support are not an acceptable means of isolation.

D. All piping shall be rigidly supported from the building structure by means of adjustable ring type hangers. Where pipes run side by side, support on rod and angle trapeze hangers. Hangers shall be spaced not greater than 5 feet on centers for cast iron piping, 6 feet on centers for copper piping and 10 feet on centers for steel piping. Plastic pipe shall be supported on not more than 3 feet centers. Round rods supporting the pipe hangers shall be of the following dimensions:

1.	1/2 inch to 2 inch pipe	3/8 inch rod
2.	2-1/2" inch to 3 inch pipe	1/2 inch rod
3.	4 inch to 5 inch pipe	5/8 inch rod
4.	6 inch pipe	3/4 inch rod
5.	8 inch pipe	7/8 inch rod

E. Rods for trapeze hangers shall be a minimum of 3/4 inch and shall have the equivalent cross section listed above per pipe supported. The use of pipe hoods, chains, or perforated iron for pipe supports will not be permitted. Insulated piping shall have hangers outside of insulation with 18 ga. protection sleeves 12" long. Anchors and guides shall be as detailed on the drawings. The Contractor shall provide inserts in the building

construction at the time the concrete is poured, and the hangers shall be attached to these inserts. Where inserts cannot be used expansion shields may be used provided the hanger is not attached rigidly to the bolt but is supported from an angle held in place by the expansion bolt. The use of expansion shields must be approved by the Architect/Engineer. See drawings and details for support of tunnel piping.

F. Hanger rods for all equipment, pipes, ducts, trapezes, vibration isolators, etc., shall be installed straight, true and plumb. Do not bend or flex hanger rods to accommodate sloping structures, avoid obstacles, or for any other purpose. Where necessary, utilize swivel beam clamps, beveled or swivel hardware, angled, swivel or hinged brackets spanning members or other appropriate means of connection.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide and erect in a workmanlike manner according to the best practices of the trade all piping shown on drawings and required for the complete installation of the systems. The piping shown on the drawings shall be considered as diagrammatic for clarity in indicating the general run and connections, and may or may not in all parts be shown in its true position. The piping may have to be offset, lowered, or raised as required or as directed at the site. This does not relieve the Contractor from responsibility for the proper erection of systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Architect/Engineer.

B. In the erection of all piping, it shall be properly supported and proper provisions shall be made for expansion, contraction and anchoring of piping. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing or forcing, properly clearing equipment and all windows, door, and other openings. Cutting or other weakening of the building structure to facilitate installation will not be permitted. All pipes shall have burrs and/or cutting slag removed by reaming or other cleaning methods. All changes in direction shall be made with fittings.

C. Preinsulated Piping Systems
   1. All piping adjoining this system shall be anchored at or near the point of connection to avoid imposing any external forces on the carrier pipe. The Contractor shall pour concrete anchor blocks at every change of direction after testing the pipe. The anchor blocks are to be sized in accordance with forces resulting from thermal stress, existing soil conditions, and shall be in accordance with the manufacturer's recommendations.
   2. Immediately after the system is installed in the ditch, a partial backfill of selected earth shall be made in the middle of each unit, leaving the joints exposed for inspection of the hydrostatic test. A hydrostatic test of 200-psig shall be required for a period of four hours. No leakage shall be allowed.
   3. After hydrostatic testing, final backfill of selected earth shall be hand placed and hand tamped to 12" minimum over the top of the jacket. Remainder of the backfill shall be free of large boulders, rocks over 6" in diameter, frozen earth, or foreign matter. The backfill operation shall now be completed by any convenient means. Do not use wheeled or tracked vehicles for tamping.
   4. The services of a factory-trained Field Service Instructor shall be required, and materials shall be stored, handled, and installed in accordance with Manufacturer's recommendations. The Field Service Instructor shall be present during critical stages of the installation and testing.

D. All open ends of pipes and equipment shall be properly capped or plugged with plugs manufactured for this purpose to keep dirt and other foreign materials out of the system. Plugs of rags, wool, cotton waste or similar materials may not be used in plugging.

E. All piping shall be arranged avoiding interference with removal and maintenance of equipment, filters, or devices; and not blocking access to manholes, access openings, etc. Flanges or unions as applicable for the type of piping specified shall be provided at the piping connections to all items of equipment.

F. Valves and specialties shall be placed to permit easy operation and access, and valves shall be regulated, packed, and adjusted at the completion of the work before final acceptance.

G. All piping shall be erected to insure proper draining. Domestic water piping may be run level but shall be free from traps.

H. Soil and waste piping and other gravity drains shall be sloped down in direction of flow minimum one inch in 20 feet.

3.2 ACCESS DOORS

A. Furnish all access doors required for access to valves, controls, or other items for which access is required for either operation or servicing. All costs incurred through failure to perform this function as the proper sequence of the work dictates shall be borne by this Mechanical Contractor.

B. The type of access door shall be as required by the room finish schedule. Acoustical tile access doors shall be equal to Krueger Style B, Style A for acoustical plaster, or Style C-CF for sidewall drywall or plaster construction.

3.3 JOINTS

A. Resilient molded gaskets shall be used on hub and spigot piping. For cast iron soil pipe not located under buildings, the Contractor may also use the No-hub sanitary system for pipe 6" and below with neoprene sealing gaskets, stainless steel retaining sleeves and two draw bands. An adequate torque wrench shall be used for system installation in accordance with manufacturer's recommendations.

B. Screwed Joints: Screwed joints shall be American Standard taper pipe threads. Ream pipe ends and remove burrs after threading. Make up joints using an approved compound or teflon tape, applied to the male threads only.

C. Brazed and Soldered Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections.

D. Welded Joints: On black steel piping 2 inches and above in size, the joints shall be welded. Welding shall be done using either gas or electric welding equipment. Certified welders shall be used. All pipe surfaces shall be thoroughly cleaned before welding. Each joint shall be beveled before being welded. Piping shall be securely aligned and spaced and the width of circumferential welds shall form a gradual increase in thickness from the outside surface to the center of the weld. The Contractor shall use appropriate materials to protect the structure and provide adequate fire protection at all locations where welding is done. All elbows shall be long radius unless otherwise specified. Wherever tee connections are made to piping systems on the main run, welding sockets may be installed for the branch connections up to one half the size of the main run. On connections larger than one half the size of the main run, welding tees shall be used. The use of fittings formed from welded pipe sections will not be permitted.

E. Flanged Joints:
   1. Cast iron flanges shall conform to the American Standard for cast iron pipe flanged fittings, Class 125 (B.16.1). Gaskets shall be suitable for the service on which used.
   2. Steel flanges shall be 150 lb. raised face type.

3.4 PUMP AND EQUIPMENT CONNECTIONS

A. All piping connecting to pumps or other equipment shall be installed with isolation valves and flexible connections to prevent strain at the connection to equipment. The Contractor shall be required as directed to disconnect piping to demonstrate that piping has been so connected. Provide a suction diffuser at each end suction pump where the inlet piping has a straight run of less than 15 pipe diameters in length. Suction diffusers shall consist of angle type body with inlet vanes and combination diffuser-strainer-orifice cylinder with 3/16-inch diameter openings for pump protection. Strainer free area shall be five times the section area of the pump connection. Provide an adjustable support foot for diffusers installed on end suction pumps.

3.5 PIPE SLEEVES

A. Pipe sleeves shall be furnished and set by the Contractor, and the Contractor shall be responsible for their proper and permanent location. Piping will not be permitted to pass through footings, beams or ribs unless so noted on the drawings or with the consent of the Architect/Engineer. Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through concrete or masonry construction and through all exterior walls, regardless of construction. Pipe sleeves, except sleeves in footings and beams shall be of sufficient diameter to provide approximately 1/4-inch clearance around the pipe, and in cases of insulated pipes, approximately 1/4-inch around the insulation. Pipe sleeves in footings and beams and exterior walls shall be of steel pipe. Sleeves in footings shall be not less than one inch or more than two inches larger in diameter than the pipe to be installed. Pipe sleeves in floors shall be cut flush with finished floor. Openings between piping and sleeves shall be made watertight with plastic cement to a minimum depth of two inches. Openings between piping and sleeves in all masonry or concrete interior walls and partitions shall be similarly caulked for acoustical reasons.

3.6 EXPANSION AND CONTRACTION

A. The Contractor shall make all necessary provisions for expansion and contraction of piping with offsets or loops and anchors to prevent undue strain.

3.7 PROTECTIVE COATINGS

A. All underground pipe except exterior cast iron water distribution pipe shall be wrapped with "Scotchwrap" No. 50 tape to give not less than two complete layers on the entire underground piping system, or piping shall have X-TRU Coat factory applied plastic protective covering.

B. All buried exterior cast iron water distribution piping shall be tar coated.

3.8 TESTING

A. Before any insulation is installed or before piping is covered or enclosed all piping systems shall be tested and proved tight at not less than 1 1/2 times the maximum service pressure which the piping systems will be required to handle, unless otherwise specified.

B. All tests shall be conducted in the presence of the Architect/Engineer and the building Owner or his representative. Any systems failing to meet the specified test requirements shall be corrected and retested until the test requirements are met.

3.9 FLUSHING, DRAINING AND CLEANING PIPE SYSTEMS

A. The Contractor shall flush water piping systems with water before placing them in operation. After systems are in operation and during the test period all strainer screens shall be removed and thoroughly cleaned. The Contractor shall notify the Architect/Engineer in writing when this requirement is to be accomplished.

B. All domestic water lines shall be sterilized as described in Section 22 11 13 - DOMESTIC WATER SYSTEM of these specifications.

END OF SECTION

SECTION 22 11 13 DOMESTIC WATER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install the Domestic Water System as shown on the drawings including specialties shown or called out in the fixture and/or equipment list and as necessary for satisfactory operation of the system.

1.3 RELATED WORK IN OTHER SECTIONS

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 05 23	VALVES
22 07 00	PIPING INSULATION
22 10 00	PIPE AND PIPE FITTINGS
23 05 19	PIPING SPECIALTIES

1.4 STERILIZATION

A. All domestic water piping shall be sterilized as described in Part 3 of this section.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Pipe and pipefittings shall be as described in Section 22 10 00 - PIPE AND PIPE FITTINGS.

B. All piping in any utilities tunnel shall have welded or silver brazed joints.

2.2 SHOCK ABSORBERS

A. Shock absorbers and/or air cushions shall be installed where shown on the drawings. Shock absorbers shall be equal to Zurn Z-1700, Diatrol Series 500 or approved equal sized for the system being protected.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation shall conform to the requirements of Section 22 05 00 - GENERAL PLUMBING REQUIREMENTS, and Section 22 10 00 - PIPE AND PIPE FITTINGS.

B. Insulating couplings shall be furnished and installed at all connections between copper and steel pipe to prevent electrolysis.

C. Each water service main, branch main, riser and branch to a group of fixtures shall be valved. Stop valves shall be provided at each fixture.

3.2 STERILIZATION

A. Domestic Water lines shall be sterilized as follows: Chlorine shall be applied to provide a solution of not less than 250 PPM. The chlorinating material shall be introduced into the waterline in a manner approved by the Architect/Engineer. The solution shall be circulated if provided with pumps and all valves in the line shall be operated several times during the contact period. After a contact period of no less than eight (8) hours the system shall be flushed with clean water until the residual chlorine content is not greater than 0.2 PPM.

B. The sterilization procedure shall be witnessed by the Architect/Engineer and Owner.

3.3 TESTS

A. General: All tests shall be conducted in the presence of the Architect/Engineer or his representative. Any systems failing to meet the specified test requirements shall be corrected and retested until the test requirements are met.

B. Water Systems: The complete water systems shall be hydrostatically tested at a pressure of 150 psi and shall show no loss in pressure for a period of one hour.

END OF SECTION

SECTION 22 11 23 NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install the Natural Gas System as shown on the drawings including specialties necessary for satisfactory operation of the system.

1.3 RELATED WORK IN OTHER SECTIONS

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 05 23	VALVES
22 10 00	PIPE AND PIPE FITTINGS

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Pipe and pipe fittings shall be as described in Section 22 01 00 - PIPE AND PIPE FITTINGS.

B. All underground gas piping shall be welded.

C. Any underground gas piping shall have a protective coating as specified in Section 22 10 00 - PIPE AND PIPE FITTINGS.

D. All gas piping in any utilities tunnel shall be welded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish and install all piping as indicated on the drawings, and all accessories in strict accordance with the applicable gas code.

B. All gas piping in any utilities tunnel shall be isolated from any metal to metal contact with hangers, supports, rails, etc.

C. Ventilated conduit shall be used to carry natural gas piping whenever such piping is run under any building, building sidewalk, structure, or through or within a concealed return air space. Ventilated conduit construction shall conform to the details shown on the drawings.

D. Gas trains connecting gas fired equipment shall conform to UL requirements.

E. All equipment (AHU, AC, Water Heaters, etc.) connected to the gas system shall be connected with gas valve, union, dirt leg with removable cap (up 4” above any surface) and flexible connection.

F. All piping and accessories shall be supported by unistrut brackets and gasketed pipe clamps, inside of the building.

3.2 TESTS

A. All gas piping shall be tested with air pressure of 60 psi and shall show no loss in pressure for a period of 24 hours on a gauge for recording pressure.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 22 13 13 SOIL AND WASTE PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install the soil and waste piping system as shown on the drawings including specialties shown or called out in the equipment list and as necessary for satisfactory operation of the system.

1.3 RELATED WORK IN OTHER SECTIONS

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 10 00	PIPE AND PIPE FITTINGS

1.4 REQUIREMENTS

A. See Sections 22 05 00 - GENERAL PLUMBING REQUIREMENTS and 22 10 00 - PIPE AND PIPE FITTINGS for general requirements.

B. Furnish and install all concrete, grout, and other required materials to fill all block outs and/or sleeves left open for this Subcontractor's convenience or for the installation of this work.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. The pipe and pipefittings shall be as described in Section 22 10 00 - PIPE AND PIPE FITTINGS.

2.2 FLOOR DRAINS

A. Drains shall be Zurn, Wade, or Smith and shall be equal to those specified on the drawings.

2.3 FLOOR SINKS

A. Drains shall be Zurn, Wade, or Smith and shall be equal to those specified on the drawings.

2.4 CLEANOUTS

A. Cleanouts shall be as manufactured by Zurn, Wade, or Smith and shall be of the same size as the pipe except that cleanout plugs larger than four inches will not be required. Cleanouts installed in connection with cast iron soil pipe shall consist of a long sweep, quarterbend or one or two eighth bends extended to an easily accessible place, or as indicated on the drawings.

B. Cleanouts in finish floors shall be of the type made to match the floor and/or covering. All exposed metal shall be polished or chrome plated brass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall conform to Section 22 05 00 - GENERAL PLUMBING REQUIREMENTS, and Section 22 10 00 - PIPE AND PIPE FITTINGS.

B. Flashings: Vent pipes shall be flashed and made watertight at the roof with sheet lead flashing. Flashing shall weigh at least four pounds per square foot, shall be 24 inches square and shall be turned up around the pipe and into the top of the pipe. Vent pipes shall extend at least 12 inches above roof.

C. Traps: Each fixture and piece of equipment connecting to the drainage system shall be equipped with a trap. Each trap shall be placed as near to the fixture as possible and no fixture shall be double trapped.

D. Floor Drains: All floor drains shall be installed with grates square with the building lines.

3.2 TESTS

A. The entire sanitary system shall be tested in accordance with the requirements of the State Plumbing Code, all local codes and ordinances, and the Uniform Plumbing Code.

END OF SECTION

SECTION 22 14 13 ROOF DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install the roof drainage system as shown on the drawings and/or listed in the fixture schedule and as necessary for satisfactory roof drainage.

1.3 RELATED WORK IN OTHER SECTIONS

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 07 00	PIPING INSULATION
22 10 00	PIPE AND PIPE FITTINGS

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Pipe and pipefittings shall be as described in Section 22 10 00 - PIPE AND PIPE FITTINGS.

2.2 SPLASH BLOCKS

A. Splash blocks shall be provided where required to prevent erosion of the soil and shall be sized to cover the splash area.

2.3 OVERFLOW DRAINS

A. Where roof drains are required, overflow drains having the same size as the roof drains shall be installed with the inlet flow line located 2" above the low point of the roof unless overflow scuppers are provided.

B. Overflow Drains shall be piped separated from the roof drains to discharge or underground storm sewer connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall conform to the requirements of Section 22 05 00 - GENERAL MECHANICAL REQUIREMENTS, and Section 22 10 00 - PIPE AND PIPE FITTINGS.

B. All roof drainage piping shall be carefully coordinated with ductwork and piping shown on the mechanical plans and routed so that no conflict occurs.

C. All roof drainage piping shall be carefully coordinated with the structural work and any conflicts shall be immediately brought to the attention of the Architect/Engineer.

3.2 TESTS

A. Roof drainage piping shall be tested by filling the system to the highest level with no drop in water level for a period of 15 minutes.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 22 15 00 COMPRESSED AIR PIPING SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install the compressed air system as shown on the drawings including compressor, air dryers, valves, pressure regulators, specialties, etc. shown or called out in the equipment list and as necessary for complete and satisfactory operation of the compressed air system.

1.3 RELATED WORK IN OTHER SECTIONS

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 05 23	VALVES
22 08 00	COMMISSIONING OF PLUMBING SYSTEMS
22 10 00	PIPE AND PIPE FITTINGS
23 05 19	PIPING SPECIALTIES

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only and shall be the latest edition.

B. American Society of Mechanical Engineers (ASME):
1. A13.1 - Scheme for the Identification of Piping Systems
2. B1.20.1 - Pipe Threads, General Purpose, Inch
3. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
4. Bl6.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
5. B16.24 - Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500
6. B18.2.1 - Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
7. B40.100 - Pressure Gauges and Gauge Attachments
8. ASME Boiler and Pressure Vessel Code -
9. BPVC Section VIII-1-2019 Rules for Construction of Pressure Vessels, Division 1

C. American Society for Testing and Materials (ASTM):
1. A47/A47M - Standard Specification for Ferritic Malleable Iron Castings
2. A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
4. A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
5. A135/A135M - Standard Specification for Electric-Resistance Welded Steel Pipe
6. A536 - Standard Specification for Ductile Iron Castings
7. A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless-Steel Nipples
8. B32 - Standard Specification for Solder Metal
9. B61 - Standard Specification for Steam or Valve Bronze Castings
10. B62 - Standard Specification for Composition Bronze or Ounce Metal Castings
11. B88 - Standard Specification for Seamless Copper Water Tube
12. B584 - Standard Specification for Copper Alloy Sand Castings for General Applications
13. B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
14. B819 - Standard Specification for Seamless Copper Tube for Medical Gas Systems

D. American Welding Society (AWS):
1. A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding

E. Manufacturer Standardization of the Valve and Fittings Industry, Inc (MSS):

1. SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends
2. SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends
3. SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service
4. SP-80 - Bronze Gate, Globe, Angle, and Check Valves
5. SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
6. SP-123 - Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube

F. National Electrical Manufacturers Association (NEMA):
1. ICS 6 - Industrial Control and Systems: Enclosures

G. National Fire Protection Association (NFPA):
1. 70 - National Electrical Code (NEC)

H. Underwriters' Laboratories, Inc. (UL):
1. 213 - ANSI/CAN/UL Standard for Rubber Gasketed Fittings for Fire-Protective Services
2. 508 - Standard for Industrial Control Equipment

1.5 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 22 0500 GENERAL PLUMBING REQUIREMENTS.

B. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

PART 2 – PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Pipe for general service compressed air system shall be drawn temper, Type "K" or "L" seamless copper tube, conforming to ASTM B88, ASTM B819 with wrought copper solder joint fittings conforming to ASME B16.22.

B. Copper unions shall conform to ASME B16.22 or MSS SP-123.

C. Cast copper alloy flanges shall be Class 300 conforming to ASME B16.24.
1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, full-face type.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

D. Solder filler metal shall consist of lead-free alloys conforming to ASTM B32 with water flushable flux conforming to ASTM B813.

E. Silver Brazing Filler metals shall be BCuP series, copper phosphorus alloys for general duty brazing conforming to AWS A5.8M/A5.8.

F. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

G. Pipe identification shall comply with ASME A13.1. Pipe identification labels shall be located as follows:
1. At intervals of not more than 20 feet.
2. At least visible once in or above every room.
3. On both sides of walls or partitions penetrated by the piping.
4. At least once in every story height traversed by risers.

2.2 VALVES

A. Ball:
1. Ball valves NPS 3 inches and smaller shall be full port, two-piece or three-piece ball valve conforming to MSS SP-110. The ball valve shall have a SWP rating of 150 psig and a CWP rating of 600 psig. The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be soldered.
2. Ball valves NPS 4 inches and larger shall be flanged, Class 250, full port steel ball valve conforming to MSS SP-72. The body shall be split design. The CWP rating shall be 285 psig. The seals shall be PTFE or TFE. Ball and stem shall be stainless-steel.

B. Check:
   1. Check valves smaller than NPS 4 inches shall be Class 250, bronze swing check valves with non-metallic Buna-N disc. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 250 psig. The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B62, solder joints, and PTFE or TFE disc.
   2. Check valves NPS 4 inches and larger shall be Class 250, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 200 psig. The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A126, bolted bonnet, flanged ends, bronze trim.

2.3 DIELECTRIC FITTINGS

A. Fittings joining copper alloy and ferrous materials shall be isolated.

B. Dielectric unions shall be factory-fabricated union assemblies, rated at 250 psig minimum working pressure at 180 degrees F suitable for compressed air service.

C. Dielectric flanges shall be factory-fabricated companion flange assemblies, rated at 300 psig minimum working pressure at 180 degrees F suitable for compressed air service.

2.4 FLEXIBLE PIPE CONNECTORS

A. Stainless-steel hose flexible connectors shall be corrugated, stainless-steel tubing with stainless-steel wire braid covering and ends welded to inner tubing. The stainless-steel hose connectors shall be rated at 250 psig minimum. The end connections for NPS 2 inches and smaller shall be threaded steel pipe nipple. The end connections for NPS 2-1/2 inches and larger shall be flanged steel nipple.

2.5 SPECIALTIES

A. Pressure Gauges: Pressure gauges permanently installed in the system or used for testing purposes shall be listed for compressed air service and shall include a snubber or pulsation dampener and an isolation valve for maintenance access.
   1. For line pressure use adjacent to source equipment: ASME B40.100, pressure gauge, single, 4-1/2 inches, for compressed air, accurate to within two percent, with metal case. Range shall be two times operating pressure. Dial graduations and figures shall be black on a white background, or white on a black background. Gage shall be labeled for appropriate service and marked "USE NO OIL".

B. Air Pressure Regulating Valves:
   1. Air pressure regulating valves under NPS 3 inches shall be pilot or diaphragm operated, bronze body and trim, direct acting, spring loaded manual pressure setting adjustment and rated for 250 psig inlet pressure. Delivered pressure shall not vary more than 1.5 psig variation in inlet pressure.
   2. Air pressure regulators NPS 3 inches and larger shall be pilot operated, bronze body, direct acting, spring loaded manual pressure setting adjustment and rated for 250 psig inlet pressure. Delivered pressure shall not vary more than 1.5 psig variation in inlet pressure.

C. Safety valves shall be constructed according to the ASME BPVC Section VIII and be National Board Certified, labeled, and factory sealed. The safety valve shall be constructed of bronze body with poppet type safety valve for compressed air service.

D. The automatic drain valves shall have stainless-steel body and internal parts rated for 250 psig minimum working pressure. The automatic drain valve shall be capable of automatic discharge of collected condensate.

E. The coalescing filter shall be capable of removing water and oil aerosols, efficiency of 99.9 percent retention of particles 0.3 micrometer and smaller, with color change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. The coalescing filter shall include mounting brackets for wall mount application.

F. Airline lubricators shall come with a drip chamber and sight dome for observing oil drop entering air stream. The airline lubricator shall have oil feed adjustment screw and quick release collar for easy bowl removal. The airline lubricators shall include mounting brackets for wall mount application. Lubricators shall be suitable for 1250 psig at 160 degrees F.

2.6 QUICK CONNECT COUPLINGS

A. The quick connect coupling assemblies shall have a locking mechanism constructed to permit one-handed feature for quick connection and disconnection of compressed air hose and equipment. Furnish complete keyed indexing noninterchangeable coupling to prevent connection to medical compressed-air pressure outlets.

B. Automatic shutoff quick couplings shall be straight through brass body with O-ring or gasket seal and stainless-steel or nickel-plated steel operating parts. The automatic shutoff quick connect coupling shall consist of socket or plug ends with one way valve and with barbed outlet or threaded hose fittings for attaching hose.

C. Valve less quick couplings shall be straight through brass body with O-ring or gasket seal and stainless-steel or nickel plated steel operating parts. The valve less quick connect coupling shall consist of socket or plug ends and with barbed outlet or threaded hose fittings for attaching hose.

2.7 HOSE ASSEMBLIES

A. Hose, clamps, couplings, splicers shall be suitable for compressed air service of nominal diameter indicated and rated for 300 psig minimum working pressure.

B. The hose shall be reinforced double wire braid, chloroprene reinforced covered hose.

C. Hose clamps shall be stainless-steel.

D. Hose couplings shall be two-piece straight through, threaded brass or stainless-steel O-ring or gasket seal swivel coupling with barbed ends for connecting two sections of hose.

E. Hose splicers shall be one piece, straight through brass or stainless-steel fitting with barbed ends.

2.8 AIR COMPRESSOR

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label receivers to comply with ASME BPVC Section VIII.

2.9 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

A. See Contract Documents for description.

B. System Design: Factory assembled automatic control system with load control and protection functions, mounted, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.

C. Control Panels: Shall comply with NEMA ICS 6, Type 12 and UL 508 labeled.
   1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
   2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage protective feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
   3. Control Voltage: 120-V ac or less, using integrated control power transformer.
   4. Motor Overload Protection: Overload relay in each phase.
   5. Starting Devices: Hands-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
   6. Automatic control switches to alternate lead-lag compressors for duplex sequence lead-lag compressors.
   7. Instrumentation: Include discharge-air pressure gauge, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gauges, and control transformer.

D. Air Receiver: Air receiver, Steel tank constructed according to ASME BPVC Section VIII, Division 1.
   1. Rated for minimum 250 psig design pressure and bearing appropriate code symbols. Including a sight gauge glass as well as a timed automatic solenoid drain valve.
   2. Interior Finish: Corrosion-resistant coating.
   3. Accessories: Include safety valve, pressure gauge, drain, pressure-reducing valve and three valve bypass on supply.

2.10 EQUIPMENT, COMPRESSORS, AIR DRYERS, ETC. SHALL BE AS SPECIFIED ON CONTRACT DOCUMENTS.

PART 3 – EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the Engineer of Record, the contractor shall correct the installation at no additional cost or time to the project.

B. Piping shall be installed concealed from view and protected from physical contact unless indicated to be exposed. Piping shall be installed exposed in mechanical rooms and service areas.

C. All pipe shall be installed at right angles or parallel to building walls. Diagonal runs are prohibited unless indicated.

D. Piping shall be installed above accessible ceilings, allowing for sufficient space for ceiling panel removal and to coordinate with other services occupying that that space.

E. Piping installed adjacent to equipment shall be located to allow for the required service clearances.

F. Air and drain piping shall be installed with a 1 percent slope downward in direction of flow.

G. Nipples, flanges, unions, transitions, and special fittings, and valves shall be installed with pressure ratings same as or higher than system pressure rating.

H. Cast copper alloy companion flange with gasket and brazed joints shall be used to connect equipment and specialties with flanged connections.

I. Flanged joints may be used instead of specified joint for any piping or tubing system.

J. Only eccentric reducers shall be installed where compressed air piping is reduced in direction of flow, with bottoms of both pipes and reducers fitting flush.

K. Branch connections shall be installed from the top of the main compressed air line. Drain legs and drain trap shall be installed at the end of each main and branch and at all low points in the system.

L. Thermometers and pressure gauges shall be installed on discharge piping from each air compressor and on each receiver.

M. Valves shall be installed to permit servicing to all equipment.

N. Pipes shall be installed free of all sags and bends.

O. Piping shall be cut square and accurately with a tube cutter (sawing is prohibited) to measurements determined at place of installation and worked into place without springing or forcing the pipe. Tube shall bottom in each solder socket so there are no gaps between tube and fitting where solder can enter the inside of line. The tube shall be reamed to remove burrs, being careful not to expand tube and that no chips of copper remain in the line. Care shall be exercised in handling equipment and tools used in cutting or reaming of pipe to prevent oil or grease being introduced into piping.

P. Particular care shall be exercised, when flux is applied to avoid leaving any excess inside the completed joints. Thoroughly wash the outside of each joint with clean hot water after assembly to remove oxide coating.

Q. Hanger spacing shall be based upon Section 220500 GENERAL PLUMBING REQUIREMENTS.

R. The Filtered Muffler shall be mounted to the air compressor outdoor intake line without the use of foundations or support frames. Silencer tubes shall be located between the filter and the housing.

S. Rigidly support valves and other equipment to prevent strain on tube or joints.

T. Compressor assembly shall have an equipment identification nameplate and data in accordance with ASME Boiler and Pressure Vessels Code and Manufacturer’s Data Requirements.

U. Suitably brace piping against sway and vibration. Bracing shall consist of brackets, anchor chairs, rods, and structural steel for vibration isolation.

3.2 TESTS

A. Compressed air piping system shall be tested at 250 psig test pressure and shall not exceed a 5 psig drop in a twenty-four-hour period.

3.3 DEMONSTRATION AND TRAINING

A. Submit training plans and instructor qualifications in accordance with requirements of Section 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS.

END OF SECTION

SECTION 22 42 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SCOPE

A. Plumbing fixtures shall be supplied, set, and connected as shown on plans. Fixtures shall be protected from damage during construction and shall be thoroughly cleaned of all tape, paint, and adhesive prior to final acceptance.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. Plumbing fixtures shall be as manufactured by KOHLER, AMERICAN STANDARD, or SLOAN and shall be as scheduled on the drawings.

B. Flush valves shall be as manufactured by Zurn, Delany, or Sloan.

2.2 FITTINGS AND PIPES

A. Fittings and piping shall be brass and whenever exposed, shall be polished chrome plated. Provide tight fitting wall and/or floor escutcheons of chrome-plated brass whenever pipes pass through floors, wall, or ceilings.

B. All porcelain or vitreous china shall be clean, smooth, and bright. All shall be warranted not to craze, discolor, or scale.

C. This contractor shall furnish and install all required water, waste, soil, and vent connections to all plumbing fixtures together with all fittings, supports, fastening devices, cocks, valves, traps, etc., leaving all in complete working order.

D. All automatic or self-closing valves for faucets shall be adjusted in accordance with manufacturer's instructions and supervised as necessary by equipment supplier's representative at the request of the Architect or Engineer.

E. Owner furnished equipment shall be connected with drains, traps, hot water, cold water and other services required for optimum operation. This contractor shall obtain information from the Owner or his approved representative for services required or field verify specific requirements.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 22 66 00 ACID WASTE AND VENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The General Provisions of the contract, including general and special conditions and the general requirements apply to the work specified in the section.

1.2 SCOPE OF WORK

A. The contractor shall supply all labor, material, and equipment to install and test the complete acid waste systems in compliance with these Specifications and the related Drawings. All incidental supports and items required for an operative system shall be included. Following certification of successful testing and when lines are marked and all work complete, the system shall be left clean and ready for operation by the Owner.

1.3 RELATED WORK IN OTHER SECTIONS

A. The following sections of this Specification shall apply to the construction, installation and testing of the acid waste system:

22 00 00	PLUMBING INDEX
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 05 13	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 10 00	PIPE AND PIPE FITTINGS
23 05 19	PIPING SPECIALTIES
23 05 48	VIBRATION ISOLATION AND EXPANSION COMPENSATION

1.4 REFERENCES

A. ASTM 4101 - Standard specification for propylene injection and extrusion materials.

B. ASTM D2657 - Practice for heat joining polyolefin pipe and fittings (Socket Fusion and Butt Fusion).

C. ASTM F1290 - Practice for Electro-fusion joining ployolefin pipe and fittings.

D. ASTM F1412 - Specification for polyolefin pipe and fittings for corrosive waste drainage systems.

E. ASTM B311 - Specification for Drain, Waste and Vent (DWV) Plastic Fittings.

F. ASTM B2447 - Standard specification for polyethylene (PE) Plastic pipe, schedule 40 and 80, based on outside diameter.

G. ASTM D1248 - Standard specification for polyethylene plastics extrusion.

1.5 OUALIFICATIONS

A. All materials shall be suitable for acid service, and shall be the products of established manufacturer, experienced in production of the particular materials, and these materials shall comply with the codes and Standards as called out in the particular section of these Specifications.

1.6 SUBMITTALS

A. All submittals shall be forwarded to the Architect for review and approval as specified in Division 1.

B. Submittals are required for the following components and systems:
   1. Piping and Fittings
   2. Valves
   3. Acid Dilution/Neutralizing Tank
   4. Valve Box
   5. Sinks, Traps, etc.

1.7 STORAGE AND HANDLING

A. For storage and handling of materials refer to Section 220500. Material shall be handled and stored so they will not be damaged.

1.8 JOB CONDITIONS

A. Work shall be coordinated by the Contractor to assure that no interference's occur due to lack of shedding the work of various crafts.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. All pipe 2" and smaller shall be Orion or Endfield with mechanical joints and all pipe 2 1/2" and larger shall be Orion or R & G Sloan Fuseal.

2.2 PIPING SPECIFICATION

Service	**Symbol**	**Operating Pressure**	**Test Pressure**
Acid Waste	AW	Gravity Flow	30 ft. water head
Acid Vent	AV	Non	30 ft. water head
Codes	ANSI B312.1		

Items	**For Sizes 2 in. and Smaller**	**For Sizes 2 ½ in. and Larger**
Pipe Fittings	Flame Retardant Polypropylene Sch. 40 ASTM D2146	Flame retardant Polypropylene ASTM D2146
Joints	Mechanical Joints for unions and fittings	Electrical Coil Fusion Weld
Flanges None	None	150 lb. Polypropylene
Acid Neutralization Tanks	Orion Model T5	Size as Noted on Plans

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in a workman like manner, with lines running parallel to building walls. All piping shall be located in accordance with the drawing and specifications and shall be adequately supported in a manner that will eliminate all sags or bowing of the line when filled with water. All horizontal runs shall be sloped and the weight of the line shall be supported entirely by the clamp and support. Hangers for acid waste mains shall be adjustable clevis type with solid rod supports. All open fittings for future connections shall be closed with q nipple and cap for thermal welded joints and with a plug for threaded joints.

B. Thermal Welded Joints - Joints shall be of the socket type using a thermal weld. Thermal welds shall be achieved with an electrical fusion coil insert heating the male and female portions of the joints. The heating tool and assemble procedure shall be in accordance with pipe manufacturer's specifications. Open flame heating of joints shall not be allowed.

C. Thread Joints

1. Connections between polypropylene pipe and fittings 2 inches and smaller shall be made with mechanical joints. Connection containing metal components are prohibited.

2. Connections between mechanically jointed pipe and fusion jointed pipe shall be special adapters according to manufacturer's recommendation.

D. Cutting - All pipe shall be cut accurately to measurements determined at the place of installation and shall be placed without springing or force.

E. Equipment and Fixtures Connections; The Contractor shall be responsible for rough-in and connection to equipment furnished by Owner and/or by others on contract documents, or under “Equipment” Sections of the Specification. This shall include any equipment requiring connection, such as sinks, direct or indirect waste, or vent piping where shown on the mechanical or plumbing drawings or not. This Contractor shall coordinate their rough-in work with the Supplier or the equipment actually being furnished and shall conform to the service requirements of furnished equipment. All final connections required by such equipment shall be made and tested by this Contractor. Carefully review the Architectural Drawings for equipment and fixture locations.

F. Acid neutralizing tank shall be installed per detail on detail sheet. Contractor shall supply initial and one additional supply of Limestone (calcium carbonate) per manufacturer’s detail and recommendations.

3.2 CLEANING

A. All pipes, valves, and fittings shall be cleaned in accordance with Section 220500 of these Specifications.

3.3 TESTING

A. Upon completion of the installation, a formal test will be scheduled by the Contractor with the Architect as a witness. A Pressure Piping Completion Record shall be completed promptly and delivered to the Owner.

3.4 IDENTIFICATION

A. All pipes shall be clearly identified in accordance with Section 220500 of these Specifications.

3.5 FINAL

A. Upon successful completion of the system testing, the system shall be left clean and ready to operate.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 23 00 00 HEATING, VENTILATING, AND AIR CONDITIONING INDEX

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Heating, Ventilating, And Air Conditioning Work, as indicated on the Drawings and specified herein. Heating, Ventilating, And Air Conditioning work indicated on the Drawings and/or specifications covering other trades shall conform to Division 23 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Heating, Ventilating, And Air Conditioning systems, shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for Heating, Ventilating, and Air Conditioning service connections to all the various items of equipment requiring connection throughout the project shown on the Contract Drawings (even if not shown on Heating, Ventilating, and Air Conditioning Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 HEATING, VENTILATING AND AIR CONDITIONING DIVISION INDEX

23 01 00	DEMONSTRATION AND TRAINING
23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 19	PIPING SPECIALTIES
23 05 48	VIBRATION ISOLATION AND EXPANSION COMPENSATION
23 05 93	BALANCING OF MECHANICAL SYSTEMS
23 07 13	DUCT INSULATION
23 08 00	COMMISSIONING OF HVAC SYSTEMS
23 21 13	HYDRONIC PIPING SYSTEMS
23 25 00	WATER TREATMENT SYSTEMS
23 30 00	AIR DISTRIBUTION

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 23 01 00 DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. After completion of the installation and upon completion of the Test and Balancing, the Contractor shall schedule the System Demonstration, Operating Test, and Training Session for the Owner.

B. The following individuals, companies or representatives thereof shall be in attendance.
1. Mechanical Trade
2. Electrical Trade
3. Sheet Metal Trade
4. Controls Trade
5. Energy Management Systems Contractor
6. Test and Balance Agency
7. Air Handler Manufacturer
8. Fan Coil Manufacturer
9. Pump Manufacturer
10. Boiler Manufacturer

1.3 RELATED WORK IN OTHER SECTIONS

23 00 00	HEATING, VENTILATING AND AIR CONDITIONING INDEX
23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 48	BALANCING MECHANICAL SYSTEMS

1.4 QUALIFICATIONS

A. The representatives listed in 1.2.B above shall be thoroughly familiar with the operation and function of the equipment or systems he represents and be prepared to indoctrinate the Owner or his designated personnel.

PART 2 - PRODUCTS

2.1 SCHEDULE

A. The Contractor shall schedule and coordinate the System Demonstration and Training Session for the Owner over 1 consecutive 8 hour working day.

B. The Owner may, after the training session has started:
1. Excuse the equipment manufacturer when his indoctrination session is completed.
2. Conclude the session early if he feels the intent and purpose of the session has been met.

2.2 ADJUSTMENTS

A. The Contractor shall have available, tools, equipment, and personnel to readjust or refine the operation of any part of the mechanical system as directed by the Owner or Architect/Engineer.

PART 3 – EXECUTION

3.1 TRAINING

A. The Contractor shall schedule and coordinate the indoctrination of the Owner and his designated personnel during the Operating Test. The proposed time schedule shall be coordinated with the individuals, companies or representatives who will be conducting the indoctrination and training. This proposed time schedule shall be submitted to the Architect/Engineer for approval.

B. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and system at agreed upon times.

C. For equipment requiring seasonal operation, perform instructions for other seasons within six (6) months.
   1. Contractor shall provide a minimum of eight (8) hours of training for seasonal system operation.
   2. Contractor shall prepare a written report of training and submit to architect upon completion of training.

D. Use operation and maintenance manuals as a basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

E. Prepare and insert additional data in Operation and Maintenance manual when need for such data become apparent during instruction.

3.2 DOCUMENTATION

A. The Contractor shall prepare an indoctrination schedule similar to the following:

INDOCTRINATION SCHEDULE:
PROJECT:
LOCATION:

PERSONNEL	ITEM/SYSTEM	DATE	START TIME	STOP TIME

B. The Owner shall initial each line to verify attendance.

3.3 OPERATING INSTRUCTIONS

A. The operating instructions specified in Sections 230500 and 253000 of these specifications shall be presented at the start of the Session. These instructions shall include manufacturer's published data having all information that does not apply crossed out.

3.4 OPERATING TEST

A. The Contractor shall conduct an operational test on all equipment installed under this Division of the Specifications. This test shall be continuous for a minimum of three consecutive days within seven days prior to the demonstration and training period with required data available at the demonstration and shall continue during the demonstration period. The test shall verify the operation of the mechanical systems and demonstrate the performance of the total system.

B. The following data shall be recorded hourly during normal building occupancy hours.
   1. Outdoor ambient temperatures:
      a. Measure and record outdoor dry bulb and wet bulb temperature.
      b. Calculate and record relative humidity.
   2. Indoor space temperature:
      a. Measure dry bulb temperature in several rooms served by each air handling unit including at least one room in each control zone. Note any variation over 2`F from setpoint.
      b. Measure wet bulb temperature in each space having a space humidistat. Calculate space relative humidity and note any variation over 5% from setpoint.
   3. Water Temperatures:
      a. Entering and leaving each piece of equipment having a water temperature change including:
         1) Boilers
         2) Air Handling Unit coils
         3) Fan Coil Unit coils
         4) Unit Heater coils
         5) Base Board Radiation
         6) Main branch loops
   4. Air Temperatures:
      a. Entering and leaving each piece of equipment having air temperature change including:
         1) DX refrigeration coils
         2) Heating water coils
         3) Air Handling Unit return, OSA and mixed air
         4) Unit Ventilator including return, OSA and mixed air
         5) Unit Heater

5. Air Pressure:
    a. Building static pressure relative to ambient (outside)
    b. Supply static pressure at outlet of each air handling unit
    c. Supply static pressure at the end of each duct run
    d. Supply static pressure at the inlet of each variable air volume terminal
6. Weather Conditions:
    a. Sun
    b. Wind velocity
    c. Precipitation
    d. Barometric pressure

3.5 READINGS AND MEASUREMENTS

A. The Test and Balance Agency shall be available and take any or all readings and measurements required or desired by the Owner or Architect/Engineer during this Demonstration and Training Session.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 23 05 00 GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General Mechanical Requirements specifically applicable to Division 23 sections in addition to Division 1 - General Requirements.

B. Scope:
   1. The work covered by this division consists of performing all operations in connection with the installation of heating, cooling, ventilating, and plumbing including site utility work as indicated under this section. This entire section applies to all mechanical work and all mechanical sections of these specifications. This Contractor shall read and comply with all sections of these specifications including all General and Special Conditions.

1.2 REFERENCES

A. Standard Requirements:
   1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. All work shall be executed in accordance with the local and state codes, ordinances, and regulations governing the particular class of work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Where these specifications and accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect/Engineer. The Architect/Engineer shall prepare any supplementary drawings required, illustrating how the work may be installed so as to comply. On approval of the change by the Architect/Engineer, the Contractor shall install the work in a satisfactory manner without additional cost to the Owner. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved, and on completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Architect/Engineer.

C. The Contractor shall secure all permits and licenses for their work and shall pay all fees in connection with such permits and licenses.

D. The contractor shall hold and save the Owner free and harmless from liability of any nature or kind arising from their failure to comply with codes and ordinances.

E. Any and all meter deposits and all utility extension costs shall be paid by the Contractor whose work is done in connection with the service that the meter is connected to.

F. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:

1.	AABC	Associated Air Balance Council
2.	ADC	Air Diffusion Council 435 North Michigan Ave. Chicago, IL 60611
3.	AGA	American Gas Association 1515 Wilson Boulevard Arlington, VA 22209
4.	AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
5.	ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
6.	ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers 345 East 47th Street New York, NY 10017
7.	ASME	American Society of Mechanical Engineers 345 East 45th Street New York, NY 10017

8.	ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
9.	AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
10.	AWS	American Welding Society 2501 NW 7th Street Miami, FL 33125
11.	FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
12.	FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Building 197 Washington, DC 20407
13.	NBFU	National Board of Fire Underwriters 5530 Wisconsin Avenue, Suite 750 Chevy Chase, MD 20815
14.	NEC	National Electric Code (of NFPA)
15.	NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
16.	NEMA	National Electrical Manufacturer's Association 2101 L Street, NW Washington, DC 20037
17.	NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
18.	NSF	National Sanitation Foundation Box 1468 Ann Arbor, MI 48106
19.	OSHA	Occupational Safety and Health Administration U.S. Department of Labor
20.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association 8224 Old Courthouse Road Vienna, VA 22180
21.	TIMA	Thermal Insulation Manufacturers Association Technical Services 1420 King Street Alexandria, VA 22314
22.	UL	Underwriters Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

G. Underwriters Laboratories Inc. (UL): All materials, appliances, equipment, devices, or appurtenances shall conform to the applicable standards of Underwriters Laboratories Inc., where such standards have been established.

1.3 DRAWINGS

A. Drawings and specifications shall be considered as cooperative, and work or materials called for by one and not mentioned in the other, or vice versa, shall be done and furnished as though treated by both.

B. In the cases of discrepancies in figures, drawings, or specifications, the Architect/Engineer shall be notified immediately, and their decision shall determine the necessary adjustment. Without such decision, said discrepancies shall not be adjusted by the Contractor save only at their expense, and, in case of any settlement or any complication arising from such adjustment to the Contractor, they shall bear all extra expense involved.

C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Architect/Engineer

for such further drawings or explanations as may be necessary, allowing a reasonable time for the Architect/Engineer to supply same, and the Contractor shall conform to same as part of the Contract.

D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Architect\Engineer whose decision shall be final and conclusive. No alleged oral admission, condonation, or inadvertent neglect on the part of the Architect/Engineer will be accepted as an excuse for inferior work.

E. The mechanical plans do not give exact details as to elevations of ductwork and piping, exact locations, etc., and do not show all offsets, control lines, pilot lines, and other installation details. The Contractor shall carefully lay out their work at the site to conform to the structural conditions, provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated, satisfactory operational installation.

F. Should the particular equipment which any Bidder proposes to install require other space conditions than those indicated on the drawings, the Bidder shall arrange for such space with the Architect/Engineer before submitting their bid. Should changes become necessary on account of failure to comply with these details, the Contractor shall make such necessary changes at their (the Contractor's) own expense.

G. The Contractor shall submit working scale drawings of all their apparatus and equipment which in any way varies from these specifications and plans which shall be checked by the Architect/Engineer and approved before the work is started, Contractor before work proceeds. Interference with structural conditions shall be corrected by the Contractor.

H. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.

I. Site visit: The Contractor shall visit the site prior to bidding and satisfy themself as the conditions under which the mechanical systems are to be installed. No subsequent allowance shall be made on their behalf for failure to make such a visit. Contractor shall examine all work noted under the demolition drawings and all new work and shall satisfy themself as to the extent of work required to be completed.

1.4 SYSTEM DESCRIPTIONS

A. Not Used.

1.5 PRIOR APPROVALS

A. Each equipment item for which the Contractor desires to install equipment other than the specific item identified in the equipment schedule or equivalent equipment by manufacturers specifically named in the schedule, the Contractor shall bear full responsibility to prove to the Engineer that the furnished equipment is equivalent to or better than the specified item. Failure to provide such proof will result in rejection of the shop drawing submittal by the Engineer. Prior written or verbal approval by the Engineer of equipment by other manufacturers will not relieve the Contractor of responsibility to provide equivalence. Prior approval is required, however, any prior approval given is intended only to provide preliminary agreement that the alternate manufacturer may make equipment that complies with the specification requirements and not that all equipment manufactured by them is acceptable.

1.6 SHOP DRAWINGS

A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this Contract. This shall include piping, ductwork, mechanical equipment, plumbing equipment, control items, etc. The Contractor shall submit to the Architect/Engineer a sufficient number of copies of all such shop drawings or catalog data to provide them with as many review copies as they may need, plus three (3) copies for retention by the Architect/Engineer. No materials or equipment shall be installed until officially approved by the Architect/Engineer.

B. Before submitting Shop Drawings to the Architect/Engineer for review, the Contractor shall examine them and satisfy themself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of Shop Drawings is not intended to take the place in any way of the official review of the Architect/Engineer, and the Shop Drawings which have not been reviewed by the Architect/Engineer shall not be used in fabrication or installing any work.

C. The review of Shop Drawings or catalog data by the Architect/Engineer shall not relieve the Contractor from responsibility for deviations from the plans and Specifications unless they have, in writing, specifically called

attention to such deviations as the time of submission and has obtained the permission of the Architect/Engineer thereon, nor shall it relieve them from the responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect/Engineer, they shall state in their letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

D. After receiving approval on the make and type of materials, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is done to facilitate progress on the job and failure on the part of the Contractor shall render them liable to stand the expense of any and all delays occasioned by failure on this part to provide necessary details. All shop drawings shall be delivered to the Architect/Engineer's office within thirty (30) days from the date of the contract.

E. Shop drawings will be returned unchecked unless the following information is included: reference to all pertinent data in the Specifications or on the drawings, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.

1.7 SUBMITTALS

A. Submittal data shall be organized in commercial quality, three ring binders with durable and cleanable covers. Product information for each piece of equipment shall be separated by an indexing leaf with clear tabs. The product name and symbol (i.e., AHU/Air Handling Unit) shall be typed on white paper inserts and placed in appropriate tab. Complete data must be furnished showing performance, quality, and dimensions. A signed review by the Architect/Engineer must be obtained before purchasing any equipment.

B. The following items shall be submitted for review by the Architect/Engineer but are not limited to:
1. Air Conditioning Units
2. Fans
3. Diffusers, Registers and Grilles
4. Fire Dampers
5. Pipe Insulation
6. Duct Insulation
7. Coils
8. Special Exhaust Fans and Filters
9. Temperature Controls
10. Cross Connection Control Devices
11. Plenum Materials and Supports
12. Pumps
13. Hydronic Air Control Devices
14. Safety Hoods and Fans
15. Filter Assemblies and Filters
16. Fan Coil Units
17. Heat Exchangers
18. Flexible Pipe Connections
19. Heating Terminal Equipment
20. Roof Top Equipment
21. Ductwork Shop Drawings
22. Radiant Heating Equipment
23. Vibration Isolation Equipment and Calculations

1.8 QUALITY ASSURANCE

A. General: Comply with Division 1.

B. Welder Qualifications: Welders shall be certified by the American Society of Mechanical Engineers (ASME) National Certified Pipe for the type of work being performed. Current operators' certificates in accordance with ASME standards shall be on file at the site and shall be available to the Architect/Engineer for examination. Coupons shall be available for review by the Architect and Engineer.

C. Locations of all pipes, ducts, outlets, appliance, etc., as shown on the drawings, are approximate only and are understood to be subject to such revisions as may prove necessary or desirable at the time the work is installed. Each Contractor will be required to install their work with relation to existing building conditions and shall be entirely responsible for the correctness of their work with reference to finished elevations, etc. Piping shown on the drawings is diagrammatic only and their exact locations, depths, and invert elevations shall be as required for proper flow and coordination with other trades.

D. The contract drawing depicts graphically the arrangement of piping and ductwork. Should local conditions necessitate a rearrangement, or if any of the piping or ductwork can be installed to better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit three (3) copies of Drawings of the proposed arrangement for the Architect/Engineer's review.

E. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, they shall assume full responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such change shall be accompanied by Shop Drawings of the space in question.

F. Each Contractor is responsible for the proper location and size of all slots, holes, or openings in the building structure pertaining to their work, and for the correct location of pipe sleeves.

G. Each Contractor shall coordinate their work with that of all other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines which require a stated grade for proper operation. Drainage lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

H. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Lubricate all equipment properly in accordance with manufacturer's instructions. Furnish zerk grease fittings on all greaseable bearings.

I. Equipment and Materials: The materials and equipment shall be new and shall be the standard products of the manufacturers regularly engaged in the production of Plumbing, Heating, Cooling, Ventilation, and Fire Protection Equipment, and shall be the manufacturer's latest standard design. Where two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer. However, the component parts of the systems need not be the products of the same manufacturer. Specific equipment specified hereinafter is to be considered a standard of quality and operation. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the drawings. Reference shall be made to the schedules for specific information. The capacities shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Architect/Engineer. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the plans, the manufacturer's instructions shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is to be installed.

J. Excavation and Backfilling: This Contractor shall do all necessary excavation and backfill for the installation of the Mechanical systems as may be required. Curb cuts, asphalt, and concrete patching, cutting, and patching existing floor, etc., shall be part of this Contractor's responsibility. No extra payment will be made for rock excavation. Trenches for all underground piping shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to assure the pipe resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe, and before laying the pipe, the space between the bottom of the pipe and the rock surface shall be filled with gravel, thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down in the trenches and shall be filled. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. The backfill material shall be identical to the surrounding fill material and shall be placed in a 6-inch layer, wetted, and compacted to the density of the adjacent soil. See Division 2 for additional information for site utilities. All surplus materials shall be hauled from the project by the Contractor at their expense.

K. Cutting and Repairing:
   1. Responsibility of the Contractor whose work is involved. Coordinate with others to prevent unnecessary cutting and repairing.
   2. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports. Arrange with those whose work is involved to do cutting and replacing caused by negligence or error with costs reimbursed by the Contractor at fault. Cutting and replacing of existing work shall be the responsibility of the Contractor whose work is being installed.
   3. Removal or terminating connections of existing work which is abandoned or replaced shall also be done hereunder to provide correct and finished work.

L. Foundations: All equipment shall be provided with suitable foundations and supports. It shall be the responsibility of the Contractor to provide for the proper locations of these foundations and supports. This applies to all rooftop equipment also.
   1. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) the conformity with the recommendations of the

manufacturer of the respective equipment, and with the approval of the Architect/Engineer. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow 1 inch below the equipment base for alignment, leveling and grouting with nonshrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed.

2. Unless otherwise noted, foundations shall be a minimum of 6- inches high. All concrete work performed by these Contractors shall conform entirely to the requirements of the Concrete Specifications which describe this class of work.

M. Code Requirements: Comply with state and local code requirements and ordinances. Call for inspections required by responsible building inspection authority.

N. Applicable Building Codes and Ordinances: Including the latest edition of each code, but not limited to the following:
1. International Building Code.
2. Uniform Mechanical Code.
3. Uniform Plumbing Code.
4. Governing Fire Department Requirements
5. Utility Company Requirements
6. National Fire Protection Association Standards
7. NFPA 70 - National Electrical Code
8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
9. NEPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
10. NFPA 13 - Sprinkler Systems
11. NFPA 101 - Life Safety
12. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment
13. International Energy Conservation Code 2021

O. Access Panels
1. Similar to Milcor, or as noted on the drawings, size as required for concealed expansion joints, valving, gauges, balancing dampers, valves, traps, pitot stations, equipment and similar items requiring accessibility. Notify the General Contractor of each access panel location and the required size. Panels shall be proper type for ceiling or wall in which they are installed. The panels shall be furnished under this section of the Specifications, unless otherwise directed, but shall be coordinated to be compatible with walls and ceilings furnished under other sections.

1.9 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1.

B. Large Items: Make arrangements with other trades on the job for introduction into the building of equipment too large to pass through finished openings.

C. Acceptance: Check and sign for materials to be furnished by others for installation under all Mechanical Divisions upon delivery. Contractor shall be responsible for the storage and safekeeping of such materials from time of delivery until final acceptance.

D. Protection: Close ends of pipe and ductwork at the close of each working day during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work with heavy paper or plastic until final clean-up.

E. Storage: Store equipment in covered enclosure or wrap with weather tight 6 mil Visqueen.

F. Shipping Protection: Protective casings, crating, and coverings to remain in place until start-up of equipment.

1.10 PROJECT CONDITIONS

A. Performance: All systems are to be rated at 4,000 ft. elevation.

1.11 SEQUENCING AND SCHEDULING

A. General: Comply with Division 1.

B. Schedule: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.

C. Utility Interruptions: Schedule mechanical utility interruptions with the Architect/Engineer/Owner minimum of seven (7) days prior to the requested outage. Plan work so that duration of the interruptions a maximum of one day.

1.12 CONTROLS WIRING AND ELECTRICAL EQUIPMENT

A. All mechanical equipment controls wiring, conduit, relays, interlocks, and all accessories required for a completely operational controls system shall be the complete responsibility of the mechanical contractor. The mechanical contractor has the option to hire the project electrical contractor or any qualified controls contractor to install mechanical controls wiring and conduit. Refer to Specification Sections 25 09 00 and 25 30 00 for coordination requirements between mechanical, electrical, and controls subcontractors.

B. Electrical items such as disconnect switches and motor starters associated with equipment provided by Division 23, when specifically mentioned to be furnished by the Mechanical Contractor, whether in these specifications or on the Electrical or Mechanical Drawings, shall be furnished by the Contractor. These items shall be mounted and connected as required for a completely operational system. See Control Systems Specification for further information.

C. All electrical equipment characteristics (voltage, etc.) must be verified by the Contractor prior to ordering. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, they shall first inform the Architect/Engineer of the change and shall then coordinate the change with the Electrical Contractor and shall pay all additional charges in connection with the change.

D. All motors shall meet all the requirements of all Electrical Divisions.
   1. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards. All general-purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. All motors shall have copper windings. All motors to have minimum power factor of 85% or have switched correction to 90%. Unless indicated otherwise, motors shall be NEMA design B with a service factor of 1.15 with 40°C rise and total temperature rise of 65°C ambient and when powered from the system voltage feeding the motor. TEFC motors shall a service factor of 1.00 with total temperature is of 65°C in the above conditions. Motors located in areas exceeding 40°C ambient shall be factory-rated for the ambient temperature of the motor environment. Single phase motors shall generally be NEMA Type N split phase induction motors with built-in thermal protectors. Single phase motors connected on loads requiring high starting torque shall be capacitor-start induction motors. Single phase motors of 1/10 HP or less may be shaded pole induction motors.

1.13 PROTECTION AGAINST HAZARDOUS CONDITIONS

A. The Contractor shall take precautions against hazardous construction conditions at all times during construction. The final condition of the facilities shall be safe, and where safety to operating personnel is jeopardized, suitable signage shall be posted.

B. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operating personnel, shall be cut back and/or protected to reduce the risk of injury. All openings between floors shall be protected with barriers around the openings, gratings across the openings, or steel bars through the openings to avoid and protect against injury.

1.14 HAZARDOUS SIGNS

A. Equipment room contains moving or rotating parts, floor openings, or other potentially hazardous environments and shall include a sign on the door entering it that shall read similar to the following: **Hazardous Area - Authorized Personnel Only.**

1.15 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Mechanical Contractor shall furnish to the Owner a bound (three (3) ring binder) manual in triplicate, containing complete repair parts lists, and operating, service, and maintenance instructions on all mechanical equipment, fixtures, and systems, as noted below:
   1. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Sub-consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

2. For Each Product System: List names, addresses and telephone numbers of Sub-contractors and suppliers, including local source of supplies and replacement parts.
3. Product Data: Mark each sheet to clearly identify specific product and component parts, and data applicable to installation. Delete inapplicable information.
4. Warranties and Bonds: Bind in copy of each.
5. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
6. Include color-coded wiring diagrams as installed for control system.
7. Operating Procedures: Include start-up, break-in and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating instructions.
8. Maintenance Requirements: Include routine procedures and guide for troubleshooting, disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
9. Provide servicing and lubrication schedule and list of lubricants required.
10. Include manufacturer’s printed operation and maintenance instructions.
11. Include sequence of operation by controls manufacturer.
12. Provide original manufacturer’s part list, illustrations, assembly drawings and diagrams required for maintenance.
13. Provide control diagrams by controls manufacturer as installed.
14. Provide charts of valve tag numbers, with locations and functions of each valve, keyed to flow and control diagrams.
15. Provide list of original manufacturer’s spare parts and recommended quantities and to be maintained in storage.
16. Include Test and Balance (T&B) Reports as specified in Section 23 05 93.

B. The Mechanical Contractor shall also provide training as required by Section 23 01 00 to the Owner’s operation and maintenance personnel.

1.16 OPERATION PRIOR TO ACCEPTANCE

A. The Owner shall have the right to operate any and all apparatus as soon as and as long as it is in operating condition, after Owner personnel have received operational training, whether or not such apparatus has been accepted as complete and satisfactory, except that this shall not be construed to mean operations before any required alterations or repairs have been made. This operation does not indicate acceptance of the equipment by the Owner. When the Contractor enters into a contract with the Owner, they agree to the above.

1.17 WARRANTY AND SERVICE PROGRAM

A. Due to the critical performance requirements and to clearly establish warranty responsibility for this project, the Contractor shall provide a full-service maintenance and warranty program to the Owner for one full year after beneficial occupancy (substantial completion).

B. This service program shall be included as part of the base bid and shall include service, maintenance, repair, replacement, lubrication, temperature control calibration and repairs, and documenting proof for all service and maintenance work on all equipment and system furnished by the Contractor.

C. A single representative in the employment of the Contractor shall be responsible for coordination and follow through of this program. This representative's name and phone number shall be submitted to the Owner as part of the maintenance manuals and supportive data. The Contractor shall respond to a request for service with 24 hours if so requested.

D. During this first year of operation, the following sequence of maintenance service shall be performed as a minimum.
1. Clean strainers in piping.
2. Fans and/or pumps be lubricated and oiled once every four (4) months.
3. Controls shall be calibrated throughout the facility at the end of six (6) months (following substantial completion). Any leaks in the piping systems shall be repaired.
4. All equipment manufacturer's service recommendations shall be followed during this period.

1.18 FLUSHING AND DRAINING

A. It shall be the responsibility of this Contractor to properly drain and flush all ducts and pipes before use or acceptance to ensure that all debris is completely removed. Damage caused by such debris remaining in the

ducts or pipes shall be repaired by this Contractor at their expense. This Contractor shall demonstrate to the Architect/Engineer's representative that all piping is clean.

1.19 CLEANING

A. This Contractor shall remove from the building construction site all rubbish and dirt as it accumulates under the contract. At completion, all areas shall be broom cleaned and all obstructions, surplus materials, etc., removed.

1.20 GUARANTEE

A. The Contractor shall guarantee all materials, equipment, and workmanship furnished and installed by them under this Contract, to be free from all defects of workmanship and materials, and shall agree to replace at their expense, without expense to the Owner, at any time within one year after installation is accepted by the Architect/Engineer, any and all defective equipment, parts, etc., that may be found. (This excludes normal maintenance and daily servicing of equipment which is the Owner's responsibility.)

1.21 FLOOR, WALL, AND CEILING PLATES

A. Where exposed pipes pass through floors, finished walls, or finished ceiling, they shall be fitted with chromium-plated escutcheons of an approved pattern. Escutcheons and plates in Mechanical Rooms do not require chrome finish.

B. This Contractor shall be responsible for providing and installing all counter flashing. All openings in the roof shall be flashed and counterflashed. Use four-pound lead flashing materials for all vent lines and welded flashing in steel lines passing through roof. The Mechanical Contractor shall notify the General Contractor where each roof penetration is and the size of the opening.

1.22 PIPE SLEEVES

A. Schedule 40 steel pipe sleeves or pipe sleeves made of No. 20 gauge galvanized steel, properly secured in place with approximately 1/4" space between each sleeve and the surface of the pipe and/or insulation passing through it, shall be provided for all pipes passing through concrete floors, roofs, and masonry walls. All pipe sleeves shall be fixed in place as the walls and floors are built up. The Contractor shall furnish and locate all sleeves and pipes passing through concrete floors, exterior masonry walls, and roofs shall be made watertight with approved non-hardening plastic material. Sleeves through pipe chase or equipment room floors shall project a minimum of 2 inches above the floor and shall be of black steel pipe with waterproof flange at center of floor thickness. Each sleeve through a fireproof wall shall be packed with approved fireproof rope in the annular space.

1.23 PIPE HANGERS

A. Pipe hangers shall be Fee and Mason of a type suitable for each use. Perforated straps shall not be used in any work. For ferrous pipes up to and including 4 inch in size, use Fee and Mason Fig. 199 malleable iron, adjustable, split ring, swivel hanger. For plumbing piping larger than 4 inches, use Fee and Mason Fig 239 steel clevis hanger. Where several pipes are parallel at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where indicated on the Drawings. For copper pipes up to and including 3 inch in size, use Fee and Mason Fig. 360 malleable iron, copper plated hangers. For copper pipes larger than 3 inches, use Fee and Mason Fig. 364 copper plated clevis hanger.

B. Hanger rod sizes shall conform to the following schedule:

1.	Pipe up to and including 2"	3/8" rods
2.	Pipe 2-1/2", 3" and 3-1/2"	1/2" rods
3.	Pipe 4" and 5"	5/8" rods
4.	Pipe 6"	3/4" rods
5.	Pipe 8”, 10”, and 12”	7/8” rods

C. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following spacing:

1.	Pipe up to and including 1-1/4"	8'
2.	Pipe 1-1/2" and 2"	10'
3.	Pipe 2-1/2" and 3"	12'
4.	Pipe 3 1/2” and 4”	14’

5. Pipe 5” and 6” 16’
6. Pipe 8” and 10” 20’

D. Unless shown otherwise on the Plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction as the case may be, by means of hangers with the following maximum spacing:
1. Pipe up to 3/4" in size 5'
2. Pipe 1" and 1-1/4" 6'
3. Pipe 1-1/2" and larger 10'

E. There shall be a hanger within 2 inches of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length of pipe. Vertical risers shall be supported by approved riser clamps at each floor. Vertical pipes within a space shall have not less than two supports.

F. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting, nor shall it be supported from equipment connection.

G. Hanger rods for all equipment, pipes, ducts, trapezes, vibration isolators, etc., shall be installed straight, true and plumb. Do not bend or flex hanger rods to accommodate sloping structures, avoid obstacles, or for any other purpose. Where necessary, utilize swivel beam clamps, beveled or swivel hardware, angled, swivel or hinged brackets spanning members or other appropriate means of connection.

H. Expansion bolts shall be Ackerman-Johnson or Hilti.

I. Beam clamps suitable for use with this type of steel construction involved shall be Grinnell.

1.24 PRESSURE VESSEL CERTIFICATION

A. Not used.

1.25 ISOLATION

A. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical Contract will be extremely objectionable and the Contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them, and consequently, they shall design all foundations, supports, etc., for their equipment, and all piping with this end in view. In addition, these Contractors shall supervise the construction of all foundations and supports, whether they build them or not, in order that they may be constructed in such a manner as to prevent the transmission of objectionable noise and/or excessive vibration. Submit calculations on all vibration isolation equipment.

B. All equipment having moving parts shall be isolated from the building structure by means of Korfund isolation materials, unless specifically noted otherwise. All isolators shall be the same brand and shall be supplied from the same source. Equipment manufacturer's recommendations shall be followed in the isolation of equipment.

C. Vibration isolators shall have sufficient resilience to meet the following minimum efficiencies:

Motor HP	Equipment Room
Up to 5	90%
7-1/2 to 15	93%
20 to 40	95%
50 to 100	97.5%

D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the baseplate, or may be unhoused stable springs. Isolators shall be furnished with snubbers and limit stops where so recommended by the equipment manufacturer.

E. The Supplier of the isolating equipment shall, upon completion of the job, check all isolating materials and verify that they are installed properly, and submit a report in writing to the Architect/Engineer.

1.26 TESTING

A. Before completion of this project, the Mechanical Contractor shall test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the Specification requirements, whichever is more stringent.

B. All equipment shall be operated sufficiently long enough to prove to the Architect/Engineer that the equipment performs satisfactorily and meets the requirements set forth on the Plans or in these Specifications.

1.27 CERTIFICATIONS

A. Before receiving final payment, the contractor shall verify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications. Submit certifications and acceptable certificates to the Architect/Engineer.

1.28 GENERAL PIPING INSTALLATION REQUIREMENTS

A. Provisions for Drainage: All piping systems shall be installed so that they may be easily drained. Drain caps, plugs, or hose bibbs shall be installed at low points. Grade piping toward drain locations.

B. Alignment: All installed pipelines shall be straight and shall remain straight against strains. Proper allowance shall be made for expansion and contraction.

C. Clean as Installed: All piping shall be kept free from scale or loose dirt when installed, and must be kept clean during the completion of the installation. All openings in the piping system shall be capped or plugged while awaiting further connections. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the system in which they are used. They shall not adversely affect the materials of mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents, and other cleaning agents shall also be compatible with the process streams to be handled by the systems in which they are used.

D. Insulated Fittings: Install between any dissimilar metals such as steel and copper.

E. Expansion and Contraction: The Contractor shall make all necessary provisions for expansion and contraction with proper fittings, anchors, dresser couplings, loops, etc. Install flexible connectors on each pipe at each building expansion joint.

F. Welding: Refer to Paragraph 1.29 of this section of these specifications.

G. Bending: No bending of pipe will be permitted.

H. General: The installation shall be coordinated with respect to space available with heating, cooling, ventilating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows, shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping, installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings or as recommended by the equipment manufacturer. Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work, and not less than 1/2 inch between finished covering on the different services.

I. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified and where directed at site. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.

J. All valves which must be used during operation, all control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation shall be located conveniently accessible from an operating platform or grade.

K. In general, relief valves within processing unit limits shall be located conveniently accessible from an operating platform or grade.
   1. Those in non-hazardous service, such as water, shall discharge directly to outside.
   2. Relief valves should have no piping between the vessel or line and the valve inlet, except as shown on the drawings.
   3. Relief valves shall be installed in a vertical position. Vent piping shall be braced and supported in a manner that will not produce excessive stresses in the relief valve and will permit removal of the relief valve without necessary temporary supports for the vent lines.

L. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings. Provide removable headers for large equipment for service access.

M. Joints
   1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be turned off. All flanged bolt holes shall straddle the horizontal and vertical center line unless otherwise noted.
   2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1 Latest Edition. Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.
   3. Solder-Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool or wire brush before seating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for serrated fittings on water, compressed air below 60 psig, and vacuum lines shall be made with a 95 percent tin and 5 percent antimony. Cored solder or solder containing lead will not be permitted.

N. Reducers: Reduction in pipe size shall be made with one piece reducing fittings. Bushings reducing at least two pipe sizes will be acceptable only when there is no room for reducing couplings or swaged nipples.

O. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union Pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.

P. Hanger Supports:
   1. All hanger rods used to support piping, conduit, mechanical units, equipment, trapezes, and other items shall be straight and installed plumb, regardless of length. Do not bend rods to adapt to sloped or rotated structural members, secondary support members or to sloped mounting holes on supported equipment. Contractor shall utilize available swivel, hinged, or rigid mounting techniques designed to accommodate a slope or rotation, or shall design a custom solution. Selected techniques for each application shall be submitted for approval prior to use.
   2. Do not bend rods to circumvent an obstruction.
   3. Loads on hanger rods shall be applied in direct tension. Do not apply compression, lateral or moment loads to hanger rods. Install bracing or additional supports to prevent hanger rod from incurring non-tension loading.
   4. Do not create offsets in rods; use only in-line couplers, and only when length of coupled rod exceeds standard available length (typically 12 feet), or when full lengths cannot be placed in position. Provide additional horizontal bracing to prevent swaying of supported piping or equipment.
   5. Do not straighten bent rods for subsequent use. If a rod becomes bent, cut off and discard the bent portion. Remaining straight portion of rod may be used.

1.29 WELDING

A. All welding of piping covered by this specification, regardless of condition of service shall be accompanied as follows:
   1. The welding shall be in accordance with the recommendations of the American Welding Society. Mitering of pipe to form elbows, notching to form these, or any similar construction will not be permitted. Welding fittings shall be installed on all welded lines. Joints to be welded shall be properly aligned and spaced, using special welding clamps where necessary. All welders to be employed shall have passed qualification tests prescribed by the National Certified Pipe Welding bureau (or by another reputable testing laboratory or agency) using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The welders will be required to pass qualification tests

when the work of the welder creates a reasonable doubt as to their proficiency. Tests shall be conducted at no additional expense to the Owner.

2. Each welder shall, in addition to having passed the prescribed qualification tests (as noted in Paragraph 1.29.A.1), prepare sample coupons at the job site on a portion of pipe that is cut such that the cross section of the weld is open to view. The sample weld should be prepared using a 6-inch diameter pipe. The sample shall reflect a continuous weld with perpendicular cut out to show the weld in cross sectional view. This sample, when accepted and approved by a certified welding inspector, shall be used as a standard of quality to compare to other welds that this welder will be performing on the job. This same sample weld will also be a basis for accepting or rejecting the welder for working on this project. The sample weld shall be identified with a date and the welder's name and shall be kept at the site throughout the project.
3. All welding on pressure piping shall conform to all of the requirements of the American Society of Mechanical Engineers Code for Pressure Piping - B31.1 (An American National Standards Institute publication), as defined in the latest edition of the ANSI Power Piping B31.1 Manual. All welding shall also conform to all of the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. All chapters, current addenda and supplements of these manuals shall apply. This code shall be used to establish standards of performance and quality of welds. However, the Owner reserves the right to perform radiographic testing of all welds, to compare any of the welds to the approved "standard" sample welds of each welder, and to compare the welds to the welding diagrams and sketches of those recommended in the ANSI B31.1 Power Piping Manual. The intent is to obtain the highest quality welding job possible. The cost of any initial radiographic testing, for random inspection, shall be paid for by the Owner. If radiographic random testing reveals that a weld is defective, the Contractor shall bear the cost of all repairs and re-testing necessary to be made to subject weld until conformance with radiographic tests is reached. The potential for random radiographic testing and welding quality control applies to all pressure piping systems in this project, including systems below 100 psig. If a question should arise regarding the possibility of faulty welding or if there are obvious visual defects in the welding, the Contractor shall be required to correct such deficiencies to a quality level consistent with the recommendations, welding diagrams and sketches in the ANSI B31.1 Manual. The quality level shall also reflect that of the approved sample welds accomplished by each welder for this particular project.

1.30 TESTING FOR PIPING SYSTEMS

A. General: Before insulation is applied, all piping, equipment, and accessories installed under this contract shall be inspected and tested by the Contractor. All labor, material, and equipment required for testing shall be furnished by the Contractor. The Contractor shall be responsible for all repairs and retesting as required. All instruments and other equipment whose safe pressure range is below that of the test pressure shall be removed from the line or blanked off before applying tests. Prior to performing tests, all lines shall be "blown" free of all loose dirt and foreign particles. The lines shall then be thoroughly flushed with water (liquid lines only) at a sufficient flow rate and period of time to ensure complete cleaning of the lines of all dirt, scale, and foreign matter. Satisfactory flushing of the lines shall be subject to approval. After testing and flushing lines, all filters and strainers shall be cleaned.

B. Safety: Since the Risk of failure, with the attendant possibility of injury, is appreciable greater with further testing, all safety measures required by codes or ordinance or reasonable applicable to the situation shall be taken.

C. Concealment: Equipment or piping to be pressure tested shall not be insulated, covered, or concealed prior to that test. Compression joint underground piping may be backfilled prior to pressure test except that joints shall remain exposed until after the test, but tie rods, clamps, etc., shall be in place and fastened.

D. Pressure Ratings: These tests shall not be used to establish pressure ratings.

E. System Protection: Protect all piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during the filling, testing, and draining procedures. Seats of iron valves shall not be subjected to a pressure in excess of the maximum cold working pressure of the valve. Pressure tests against other closed valves shall not exceed twice the normal rating. Note that where significant differences in elevation exists, there is a risk of overpressure in the lower portions of the system in order to attain test pressure in the upper portion of the system.

F. Test Temperature: Apply test pressure only after the system and test medium are at approximately the same temperature, preferably not less than 60°F. Note that some applicable codes require testing above a specified minimum temperature.

G. Sectionalizing: Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.

H. Temporary Supports: During hydrostatic testing of lines provide temporary supports to prevent overstressing supports or hangers. When tests are completed, remove all temporary supports, locks, stops, etc., and adjust supports for their cold load and alignment.

I. Testing: Domestic hot and cold water piping and heating water piping shall be tested hydrostatically at the test pressures specified and shall show no drop in pressure in a 2-hour period. Leaks shall be located by soap testing
   1. Test Pressures:
      a. Condenser or Tower Water Supply & Return: 100 psig.
      b. Heating Water Supply and Return: 100 psig.
      c. Chilled Water Supply and Return: 100 psig.
      d. Steam and condensate (high pressure): 250 psig.
      e. Steam and condensate (low pressure): 125 psig.

J. Test Report
   1. A detailed report of pressure tests on piping and equipment shall be forwarded in duplicate to the Architect/Engineer. This report shall show date of test, lines tested, test medium, length of time test pressure was held, pressure drop or rise, and extent of venting or repressurizing.

1.31 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other sections of these specifications covering the work of other trades which must be carried out in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay, or absence of coordination.

1.32 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions covering the mechanical work at the building. No extra compensation shall be claimed or allowed on account of difference between actual dimensions and those indicated on the drawings. They shall examine the adjoining work on which Mechanical work is dependent for maximum efficiency, and shall report any work which must be corrected. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting Mechanical work.

1.33 SAFETY GUARDS

A. The Mechanical Contractor shall furnish and install safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded. Provide coupling guards on all rotating shafts.

1.34 PROTECTION

A. All work, equipment, and materials shall be protected at all times to prevent obstruction, damage, or breakage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected against dirt, water, chemical, or mechanical injury. At the completion of the work, all equipment shall be thoroughly cleaned, and the entire system shall be delivered in a perfect, unblemished condition.

1.35 PAINTING AND IDENTIFICATION

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance.

B. Except as elsewhere hereinafter specifically required, any painting of equipment, piping, ductwork, grilles, insulation, etc., furnished and installed under this Section of the Specifications will be done by the Painting Contractor. However, the Mechanical Contractor shall leave their equipment clean and free from any grease, dirt, rust, etc., and in suitable condition for painting.

C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.

D. The piping shall be painted the basic color as indicated in other sections of these specifications and shall be marked every 10 feet on centers with Brady pipe markers. Arrows, approximately 6 inch in length and spaced about 10 feet on centers shall indicate the direction of the flow pipe. Locate additional labels as required in Mechanical Rooms. Staple in place, brush with clear lacquer. Markers shall state pipe size, flow direction, and pipe usage (such as "cold water," etc.).

1.36 RECORD DRAWINGS

A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all dimensional locations of equipment piping and all deviations and/or changes in the work shall be recorded. Water, storm, and drainage mains shall be delivered to the Architect/Engineer in good condition upon the completion and acceptance of the work and before final payment is made.

1.37 SUPPLIER RESPONSIBILITY

A. Each supplier, whether furnishing equipment as specified or as a substitution shall be responsible for certifying that the equipment is properly installed and that the warranty is valid. Submit written reports on the installation and the equipment performance when requested to do so by the Architect/Engineer (or their representative). Each supplier shall be responsible for furnishing qualified personnel at the job site at any time requested by the Architect/Engineer (or their representative) during the construction or warranty periods.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. It is the intent of this specification to define all motors furnished under all sections of the specifications for this project which will provide efficient operation, reliability, ease of maintenance, and repair along with reduced operation costs.

B. All general-purpose motors shall be open drip-proof machines for installation indoors and/or in protected locations. Totally enclosed fan cooled (TEFC) motors shall be used in all areas of exposure to weather or other environmental contamination. Motors shall be rated explosion-proof when located in hazardous atmospheres.

C. Motors mounted in direct sun shall be provided with a shield to forbid direct radiation from the sun when the sun is 45 degrees or greater above the horizon.

D. All supply fan motors mounted in air handling units shall have Class F insulation.

E. Open drip-proof motors shall be NEMA design B with Class B insulation and a 1.15 service factor with 40-degree C ambient and a total temperature rise of 65 degrees C.

F. TEFC motors shall be NEMA design B with Class F insulation and a 1.15 service factor with 40-degree C ambient and a total temperature rise of 65 degrees C.

G. Severe duty motors shall be NEMA design B with Class F insulation and a 1.15 service factor with 40-degree C ambient and a total temperature rise of 65 degrees C.

1.3 GENERAL

A. All motors covered by this specification shall conform to all applicable requirements of NEMA, IEEE, ANSI and NEC Standards. They shall be free from defective material and workmanship and fully capable of performing in accordance with the manufacturer's nameplate rating.

B. Motors shall be approved by Underwriter's Laboratories (UL) for the service specified.

C. Unless otherwise specified, motors shall be suitable for operation in either direction--(CW or CCW) or rotation.

D. Motors shall be Westinghouse II, Reliance XE, Gould E-PLUS, GE Energy Savery, or approved equal.

E. All fractional H.P. motors shall be permanent split capacitor (P.S.C.) with U.L. listed overload protection. The protector shall be calibrated to trip out when the winding reaches a pre-determined temperature and automatically reset when the temperature returns to a safe limit.

1.4 EFFICIENCY

A. All motors shall be special high efficiency design. These motors shall be different than manufacturers' standard product, in that losses are reduced by incorporation of design features including the use of low loss lamination steel, increase in stator/rotor length, increase in copper windings, utilization of high efficiency ventilating fan, computer optimized slot configuration and air gap.

B. All motors shall be all copper wound, high power factor, high efficiency motors. Motor efficiency shall be as determined by IEEE Standard 112A, test method B. Test results shall be submitted to the Engineer.

C. Manufacturer to furnish % efficiency, % PF, amps at Full Load, 3/4 Load, and 1/2 Load with quotation and be prepared to furnish actual test results on individual ratings if required.

PART 2 - PRODUCTS

2.1 GENERAL

A. Motors shall be 60 Hertz voltage as indicated on drawings, Squirrel Cage induction type suitable for across-the-line starting and continuous duty.

B. Motors shall have copper windings.

C. All motors shall be suitable for application without exceeding Class B rise in ambient temperatures up to and including 65 degree C at 1.15 Service Factor. Motor nameplates shall state suitability for 65-degree C ambient application.

D. All motors shall be suitable for application without exceeding Class B temperature rise at altitudes up to and including 9900 feet at a 1.00 Service Factor.

E. Motors shall operate successfully under running conditions at rated load with +10% of rated voltage or +5% of rated frequency or a combined variation in voltage and frequency of +10% (sum of absolute values).

F. Motors will have at least a nominal 85% power factor rating at full load and rated voltage. Exclusion from this requirement are motors which draw less than 1,000 watts at full load and motors with synchronous speeds less than 1800 RPM. Test verification shall be available upon request.

2.2 INSULATION

A. Motors shall have non-hygroscopic Class B or Class F insulation system as required; however, temperature rise shall not exceed Class B rise at rated load per NEMA Standards.

B. The insulation system shall be provided with sufficient treatment so that the completed insulation system will have a minimum resistance of 1.5 megohms after 168 hours of testing to a humidity chamber maintained at 100% relative humidity and 40-degree C ambient.

2.3 TESTS

A. Each motor shall be given a routine factory test per NEMA and ASA Standards to ensure compliance with this specification.

2.4 BEARINGS

A. Bearings shall be shielded, regreasable, vacuum degassed steel ball bearings, specially selected for electric motor service and long-life expectancy (B-10 MINIMUM).

B. Bearings shall be lubricated with a premium moisture resistant grease formulated to operate over a temperature range of -20 degrees F to +300 degrees F.

C. Bearing identification by AFBMA number shall be shown on motor nameplate.

2.5 ENCLOSURES

A. Construction shall be of rugged corrosion resistant metal including a one-piece frame, brackets, conduit box and fan shroud.

B. Fans shall be bi-directional and constructed of low inertia inert material.

2.6 CONDUIT BOXES

A. Conduit boxes are to be diagonally split, rotatable in 90 degree turns, gasketed cast iron construction with threaded conduit holes.

B. Ground lug suitable for grounding motor frame shall be furnished inside of conduit box.

C. A neoprene lead seal separator gasket shall be mounted between motor frame and conduit box to prevent entry of moisture and dust into the motor.

D. Conduit box size must meet or exceed minimum as shown in NEC Standards based on motor full load current.

2.7 HARDWARE

A. Corrosion-resistant cadmium plated grease plugs shall be provided for relubrication of bearings.

B. An external shaft flinger shall be provided on the shaft to prevent entrance of moisture or dust into the bearings.

C. All motors Frame 182T and larger shall have lifting eyebolts for lifting the entire motor.

D. An easy-to-read nameplate shall be provided on each motor and shall include at least the following information:
1. Horsepower
2. RPM
3. NEMA Design
4. Phase
5. Hertz
6. Service Factor
7. Ambient Temperature
8. Frame Size
9. Duty
10. Class of Insulation
11. Locked KVA Code
12. Full Load Amps
13. Model or Catalog Number
14. Bearing Identification
15. Guaranteed Minimum Efficiency
16. Nominal Efficiency
17. Voltage

2.8 MOTOR CONSTRUCTION

A. Motors shall be dynamically balanced to limits as indicated below:

Speed	Maximum Amplitude (Peak-to-Peak)
3500 & Above	.0010
1700 to 3499	.0015
Less than 1700	.0020

2.9 FINISH

A. All external surfaces shall be prime painted with red oxide zinc chromate primer to prevent corrosion.

B. The finish coat of paint shall be a full-gloss epoxy enamel paint. External finish shall protect against moisture and have superior heat resistance to withstand the effects of sunlight and outdoor weathering without chipping or cracking.

2.10 EFFICIENCY

A. Motors furnished shall meet or exceed the efficiency listed on the following Table.

HIGH EFFICIENCY MOTORS

HP	3600 RPM EFFICIENCY		1800 RPM EFFICIENCY		1200 RPM EFFICIENCY	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM	NOMINAL	MINIMUM
1	81.5	78.5	84.0	81.5	78.5	75.5
1.5	81.5	78.5	84.0	81.5	84.0	75.5
2	84.0	81.5	84.0	81.5	86.5	84.0
3	86.5	84.0	88.5	86.5	88.5	86.5
5	88.5	86.5	90.2	88.5	88.5	86.5
7.5	88.5	86.5	90.2	88.5	88.5	86.5
10	88.5	86.5	90.2	88.5	90.2	88.5
15	90.2	88.5	91.7	90.2	90.2	88.5
20	90.2	88.5	91.7	90.2	91.7	90.2
25	90.2	88.5	93.0	91.7	91.7	90.2
30	91.7	90.2	93.0	91.7	91.7	90.2
40	91.7	90.2	93.0	91.7	93.0	91.7
50	91.7	90.2	94.1	93.0	93.0	91.7
60	93.0	91.7	94.1	93.0	93.0	91.7
75	94.1	93.0	94.1	93.0	94.1	93.0
100	94.1	93.0	95.0	94.1	94.1	93.0
150	94.1	93.0	95.0	94.1	94.1	93.0
200	94.1	93.0	95.0	94.1	95.0	94.1
250	95.0	94.1	95.0	94.5	-	-

END OF SECTION

SECTION 23 05 19 PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install all piping specialties necessary for satisfactory operation of the systems.

B. Manual air vents shall be installed at all high points in heating water piping systems and as shown on the contract drawings.

C. Valves shall be installed in all primary and secondary plumbing loops and branch lines feeding groups of fixtures in order to isolate such loops and branches without disrupting the service as a whole.

D. Unions shall be installed where necessary to facilitate maintenance of pumps, valves, regulators, and other specialties.

E. Dielectric unions shall be installed wherever dissimilar metals are joined, except valves in closed loop piping systems.

1.3 RELATED WORK IN OTHER SECTIONS

22 05 23	VALVES
22 07 00	PIPING INSULATION
22 10 00	PIPE AND PIPE FITTINGS
22 11 13	DOMESTIC WATER SYSTEMS
22 11 23	NATURAL GAS PIPING SYSTEMS
22 13 13	SOIL AND WASTE PIPING SYSTEMS
22 14 13	ROOF DRAINAGE SYSTEMS
23 00 00	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
23 05 00	GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 48	VIBRATION ISOLATION AND EXPANSION COMPENSATION

PART 2 - PRODUCTS

2.1 STRAINERS

A. Mueller Steam Specialty model 352M cast bronze, threaded ends, y-strainer, 20 mesh stainless steel screens for water service and .033” dia. opening screens for steam service. Provide blow-off valves full size of strainer tapping with drain lines to nearest drain.

B. Mueller Steam Specialty model 752, 250 SWP, flanged for size 2-1/2” and larger with 1/16” dia openings screen for water and 3/64” dia openings stainless steel screen for steam. Provide blow-off valves full size of strainer tapping with drain lines to nearest drain.

2.2 PRESSURE GAUGES

A. Marshalltown “Permagage”, Ashcroft “Duragage”, “Trerice No. 500X, or approved equal. Dials shall be 4-1/2” unless otherwise noted. Proved needle valve for each gauge, and syphon for each steam gauge. Pressure gauges shall be range noted on plans or at mid range of service (as shown on drawings).

2.3 THERMOMETERS

A. Where indicated on the drawings and the piping diagrams, thermometers shall be installed as manufactured by the H.O. Trerice Co., Mueller, Albert Weiss, or approved equal. Thermometers shall be provided with expansion heads so that thermometer will not break under extremes of temperature. Each thermometer shall be provided with a separable socket well which shall be place in the piping system. The well shall be the length required for accurate reading of the thermometer.

2.4 AIR VENTS

A. Manual air vents shall be 1/2” brass ball valves, Nibco No. T-585-70 or approved equal.

2.5 THERMOMETER WELLS

A. Machined brass test wells with screwed caps and chains. H.O. Trerice No. 5573 or 5574 as required, or approved equal.

B. Temperature and Pressure Test Plugs: Furnish pressure and temperature test plugs at all locations as shown on the drawings and at every connection to each piece of equipment. These test plugs shall be furnished with a Nordel valve core and 1/2” NPT brass body complete with gasket cap.

C. Furnish 4 each thermometers and pressure gauges for use by the Owner for checking temperatures and pressures.

2.6 INSULATING UNIONS

A. Insulating unions having a plastic insert for electrical isolation shall be similar to EPCO Sales Company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All specialties shall be installed in accordance with the best standard practices and as recommended by the manufacturer.

B. Where thermometers or test fittings occur in insulated piping systems or on insulated equipment, extension necks shall be provided to extend beyond the insulation. See drawings for locations.

C. Dielectric union shall be installed wherever piping of dissimilar metallic material is connected. Insulating unions are not required between bronze valve bodies and connecting steel pipe in closed loop systems such as heating and chilled water systems.

D. Strainers shall be installed in direction of flow with valved plugged a minimum of 6” from strainer. Strainers shall be installed ahead of coils, equipment, etc. whether or not shown on drawings for all HVAC equipment. Strainer shall be on outlet side of pumps and similar equipment.

E. Air vents shall be installed at all high points in hydronic systems for heating water and chilled water piping system.

END OF SECTION

SECTION 23 05 48 VIBRATION ISOLATION AND EXPANSION COMPENSATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Vibration Isolation: All vibration isolation equipment including flexible pipe and duct connections hangers and bases shall be under the direct supervision of the vibration isolation manufacturer's representative. This specification provides the necessary design criteria to avoid excessive noise or vibration due to the operation of machinery, connecting piping, ductwork, or conduit.

1.3 RELATED WORK IN OTHER SECTIONS

22 05 23	VALVES
22 07 00	PIPING INSULATION
23 00 00	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIOING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 19	PIPING SPECIALTIES
23 21 13	HYDRONIC PIPING SYSTEMS

1.4 CONTRACTOR RESPONSIBILITY

A. The Contractor shall provide a submittal to the Architect/Engineer for approval prior to any installation of his equipment containing the following information:
   1. Catalog cuts and data sheets on specific vibration isolators to be utilized showing compliance with this specification and the recommendation of the isolator manufacturer as to suitability for the specific service.
   2. An itemized list showing the items of equipment, piping, and ductwork to be isolated, the isolator type and model number selected, isolator loading and deflection, and reference to specific drawings showing equipment frame construction where applicable.
   3. Drawings showing equipment frame construction for each machine, including dimensions, structural member sizes, support point locations, etc.
   4. Written approval of the frame design to be used, obtained from the equipment manufacturer.
   5. Drawings showing methods of suspension, support, guides, etc., for piping and ductwork.
   6. Drawings showing methods for isolation of piping and ductwork piercing walls, slabs, beams, etc.
   7. The Contractor shall bring to the Architect/Engineer's attention prior to installation any conflict with other trades which will result in unavoidable contact to the equipment, piping, etc., described herein, due to inadequate space. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
   8. The Contractor shall bring to the Architect/Engineer's attention any discrepancies between the specifications and field conditions, changes required due to specific equipment selection, etc., prior to installation. Corrective work necessitated by discrepancies after installation shall be at the expense of the Contractor.
   9. The Contractor shall obtain inspection and approval from the Architect/Engineer of any installation to be covered or enclosed prior to such closure.
   10. The Contractor shall obtain written and/or oral instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices; alternatively, the equipment may be installed by the vibration isolation manufacturer.
   11. The Contractor shall correct, at no additional cost, all installations which are deemed defective in workmanship or materials by the contracting officer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Vibration isolation equipment shall be as manufactured by Flexonics, Kinetics, Mason Industries, Vibration Eliminator, Co., or approved equal.

2.2 ISOLATOR TYPES

A. Spring Type
   1. All spring isolators shall have either known undeflected heights or other markings so that, after adjustment, when carrying their load the deflection under load can be verified, thus determining that the

load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
2. All spring isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range 50% above the design deflection.
3. The ratio of lateral to vertical stiffness shall not be less than 1.0 or greater than 1.6.
4. The vertical natural frequency for each support point, based upon the load per isolator, and isolator stiffness, shall not differ by more than plus or minus 10%.
5. Type MS shall be bare spring type (without housings or snubbers) equipped with leveling bolts and with two layers of ribbed or waffled neoprene pad separated by a 1/16 " galvanized steel plate under the base plate.
6. Type HS shall be suspension hanger having a steel frame and spring element in series with a neoprene pad or washer. The isolator shall be designed so hanger rod may be misaligned 15 relative to the vertical without touching hanger box frame.

B. Neoprene Pad Type
1. Type MN shall be a neoprene isolator unit having a minimum static deflection of 1/4" and show hardness of 40 to 65 after minimum aging.

C. Flexible pipe connectors shall consist of a minimum 12-inch length of metal reinforced or corrugated flexible metal hose of appropriate pressure and temperature rating with end connections suitably for the adjacent piping system. Connectors shall be Flexonics type MMT FLG or Vibrasorber or approved equal.

D. Flexible duct connectors shall be neoprene coated glass fabric, ventglass or equal. See Section 233000 - AIR DISTRIBUTION.

2.3 EQUIPMENT FRAMES AND BASES

A. General:
1. Equipment frames and base shall be furnished and installed where specifically shown on the drawings and at other locations recommended by the isolator manufacturer. In general, rigid steel frames will be required for base mounted pumps, 30 HP and smaller, air handling units, some fans 30 HP and smaller, water chillers, cooling towers. Concrete inertia bases shall be furnished and installed for base mounted pumps 40 HP and larger and fans 40 HP and larger.

B. Rigid Steel Frames
1. Mounting frame and/or brackets shall be provided to carry the load of the equipment without causing mechanical distortion or stress to the equipment.
2. The mounting frames shall consist of welded wide flange of channel structural steel with welded brackets to accept the isolators. The section depth of the frame member shall be greater than 1/10 the length of the longest frame member.

PART 3 - EXECUTION

3.1 GENERAL

A. Location: Vibration isolation equipment shall be installed at the following locations and at other locations recommended by the isolator manufacturer or required to reduce transmitted vibrations to a level acceptable to the Architect/Engineer and Owner.
1. All reciprocating or rotating equipment such as fans, AHU's, forced draft boilers, chiller, cooling towers, furnaces, pumps, and compressors except as follows:
   a. Equipment installed on slab on grade construction.
   b. AHU's having factory installed internal spring isolation at fans.
   c. Inline pumps having motors 1/2 HP or smaller.
2. At all connections between rotating equipment and piping or ductwork.
3. All piping and ductwork within mechanical equipment rooms or within 10 feet of connections to rotating or reciprocating equipment.

B. The Contractor shall install equipment and piping avoiding rigid contact with the building structure.

C. The Contractor shall coordinate his work with other trades to assure rigid contact between the building structure and mechanical equipment and piping is minimized.

3.2 INSTALLATION

A. Large Equipment
   1. Objective: Installation of vibration isolators shall not result in any change of position of equipment or piping which would result in stresses in piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. Equipment shall be shimmed into final, loaded position prior to making piping connections. Equipment load shall not be transferred to the isolator until the installation is complete and the equipment is under full operational load. This is particularly important where equipment installation weight is substantially different from operating weight such as cooling towers, chillers, boilers, air washers and evaporative coolers which operate with substantial water content.
   2. The machine to be isolated shall be supported by a structural steel frame or concrete inertia base.
   3. Brackets shall be provided to accommodate the isolator and provide a mechanical stop. The vertical position and size of the bracket shall be specified by the isolator manufacturer.
   4. The operating clearance at steel frames between the bracket and the pad or floor shall be 3/8 inch, plus or minus 1/16 inch. The minimum operating clearance between the frame and the housekeeping pad or floor shall be one inch.
   5. The frame shall be placed in position and the brackets supported temporarily by 3/8-inch shims prior to the installation of the machine or isolators.
   6. The isolators shall be installed without raising the machine and frame
   7. After the entire system installation is completed and under full operational load, the isolator shall be adjusted so that the load is transferred from the shims to the isolator. When all isolators are properly adjusted the shims will be barely free and shall be removed. Thereafter, the shims will be used as a gauge to check that the 3/8-inch clearance is maintained so that the system will remain free of stress.

B. Pipe and Duct Hangers
   1. General: Vertical rise and horizontally supported piping connected to reciprocating or rotating equipment are included herein. Domestic water and fire standpipe systems are excluded from this section of the specifications.
   2. Pipe and duct hangers shall be suspended from spring isolators within mechanical equipment rooms and within 10 feet of connections to rotating or reciprocating equipment.
   3. The isolators shall be installed with the isolator hanger box as close as possible to the structure.
   4. The isolators shall be suspended from substantial structural members, not from slab diaphragms unless specifically approved.
   5. Hanger rods shall be aligned to clear the hanger box.
   6. Horizontal suspended pipe 2" and smaller shall be suspended by HS isolator type with a minimum 1.0-inch static deflection. Pipes larger than 2" shall be the same except with a minimum of 1-1/2" static deflection.
   7. Horizontal pipe floor supported at slab shall be supported via Type MS with a minimum static deflection of 1.0 inch.
   8. Vertical riser pipe supports shall utilize Type MS mounts selected for a minimum static deflection of 1.5 inches.
   9. Vertical riser guides, if required, shall utilize Type MN mounts to avoid direct contact of piping with building.
   10. Pipe sway braces where required shall utilize two neoprene elements (Type MN) to accommodate tension and compression forces.
   11. Hanger rods for all equipment, pipes, ducts, trapezes, vibration isolators, etc., shall be installed straight, true, and plumb. Do not bend or flex hanger rods to accommodate sloping structures, avoid obstacles, or for any other purpose. Where necessary, utilize swivel beam clamps, beveled or swivel hardware, angled, swivel or hinged brackets spanning members or other appropriate means of connection.

C. Pipe Clamps:
   1. All piping whether or not spring isolated hangers are used, shall be supported with a resilient wrapping or clamp system employing a resilient element of wool felt, neoprene or other suitable material.

D. Flexible pipe connectors shall be installed between each piece of rotating or reciprocating piece of equipment and the distribution piping system.

E. Flexible duct connectors shall be installed between each unit containing a fan and the distribution ductwork. Allow at least 1" slack in fabric connectors. Fabric may be attached to ductwork by folding into the sheet metal or attaching with metal flanges.

F. Flexible duct connectors for kitchen hood exhaust systems shall be slip joint type with high temperature resilient packing material.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 23 05 93 BALANCING OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish all labor, materials and equipment required to test and balance the mechanical systems identified on the contract drawings and these specifications, including but not limited to:
   1. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.
   2. Measurement of final operating condition of HVAC systems.
   3. Sound measurement of equipment operating conditions.
   4. Vibration measurement of equipment operating conditions.
   5. Adjustment of the mechanical systems shall include but not limited to impellers trimmed, new sheeves and belts to match cfm required, etc. as required to match equipment specified.
   6. Operating Test

1.3 RELATED SECTIONS

23 00 00	HEATING, VENTILATING AND AIR CONDITIONING INDEX
23 01 00	DEMONSTRATION AND TRAINING
23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 30 00	AIR DISTRIBUTION
25 10 00	DIRECT DIGITAL CONTROLS (DDC) SOFTWARE AND COMPONENTS.
25 11 00	ELECTRICAL CONTROLS AND INTERLOCKS
25 30 00	CONTROLS AND INSTRUMENTATION

1.4 REFERENCES

A. The publications listed below form a part of these specifications to the extent referenced. Each publication shall be the latest edition of each except as noted.
   1. AABC - National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning System.
   2. ADC - Test Code for Grilles, Registers, and Diffusers.
   3. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
   4. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
   5. NFPA – NFPA 90A - Installation of Air Conditioning and Ventilating System.
   6. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.5 SUBMITTALS

A. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

B. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.

C. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.

D. Provide reports in letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

E. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

F. Test Reports: Indicate data on AABC National Standards for Total System Balance forms.

G. When test and balancing has been completed, the balancing agency shall prepare a complete report including design and test conditions compared. The report shall be as outlined below.

H. Seven copies of the complete and compiled test data shall be submitted to the Contractor for forwarding to the Architect/Engineer for evaluation and approval.
   1. The Report shall be on standard 8-1/2” x 11” good quality paper and bound together to form a complete report. All forms shall be typewritten. Field data may be handwritten on appropriate printed or typewritten forms. Copies of handwritten field notes shall be legible.
   2. Each sheet shall have the Building number, name of the Testing Firm, instruments used to perform the tests, name of personnel performing the test, and date test was performed. Date and firm performing the calibration on photometry equipment shall also be included.
   3. Outside weather conditions shall be noted during the times the tests were made; cloud cover, temperature, wind speed and direction, precipitation, etc.

I. The Report shall have a T & B Summary section including:
   1. Identification of any system or equipment item the Contractor had difficulty balancing to specification or could not be balanced to specification.
   2. Identification of any piece of equipment or system whose balance should be rechecked and/or reset during weather conditions different from those present during system balancing.

1.6 PROJECT RECORD DOCUMENTS

A. Record actual locations of flow measuring stations balancing valves and rough setting. Show locations on Test and Balance report reduced size plan drawings.

1.7 QUALITY ASSURANCE

A. Perform total system balance in accordance with NEBB Procedural Standards for Testing, Balancing, and Adjusting of Environmental Systems.

1.8 QUALIFICATIONS

A. The balancing shall be performed by Energy Balance, Inc., Advanced Air Flow Technology, or CloverLEAF. Qualified personnel are limited to registered mechanical Engineers and agencies regularly engaged in testing and balancing work. The Contractor shall submit, prior to the start of the balancing work, the qualifications and experience record of the balancing personnel for approval by the Architect/Engineer.

B. Perform Work under supervision of registered Professional Engineer experienced in performance of this Work and licensed in the state where the Project is located.

C. The balancing agency shall not be associated with or the same contractor furnishing the controls or instrumentation.

1.9 PRE-BALANCING CONFERENCE

A. Convene pre-balancing conference one week prior to commencing work of this section in coordination with Architect/Engineer/General Contractor and his Subcontractors.

1.10 SEQUENCING

A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project. See section 3.1 for pre-balancing inspection.

PART 2 - PRODUCT

2.1 INSTRUMENTS

A. Instruments in general shall be direct reading. Pressures between 2" W.G. and 12" W.G. shall be measured with manometers. Duct velocities above 600 fpm shall be measured with a pitot tube. Averaging hoods with tight seal shall be used for airflow measurement at diffusers, registers, and grilles. RPM shall be measured with a revolution counter and stopwatch. Mercury thermometers are preferred; bi-metallic thermometers may be used if calibration is checked daily. Test report shall list all instruments used and include accuracy and

date calibrated. The Contractor shall provide all instruments to make the tests herein specified and required for complete system balancing.

2.2 AIR HANDLERS

A. After the air system is balanced and an optimum fan speed is selected, the adjustable sheaf or sheaves furnished shall be replaced by the Mechanical Contractor with new non-adjustable sheaves for permanent operation.

2.3 PUMPS

A. After the water system is balanced and an optimum pump operating point is selected, the pump impeller shall be trimmed to supply the required capacity for pumps over 2 HP, without throttling the flow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The test and balance agency shall review the plans and specifications prior to installation of the system and submit a report to the Architect/Engineer of any deficiencies in the system which could preclude proper adjusting, balancing, and testing of the system.

B. The test and balance agency shall inspect the system prior to adjusting, balancing, and testing work to ensure that all specified components which will affect proper execution of such work are installed and are operating properly. A report shall be submitted to the Architect/Engineer indicating the results of the inspection within three days of the inspection. The following is a partial list of items to be inspected and report provided to the Architect/Engineer.
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems and control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire/smoke and volume dampers are in place and open. The smoke detectors and power to them is installed and the dampers are operational. Air coil fins are cleaned and combed.
   8. Access doors are closed and duct end caps are in place.
   9. Air outlets are installed and connected.
   10. Duct system leakage is minimized.
   11. Hydronic systems are flushed, filled, and vented.
   12. Pumps are rotating correctly.
   13. Proper strainer baskets are clean and in place.
   14. Service and balance valves are open.

C. Submit field reports in a timely manner within one week of pre-balancing conference. Report defects and deficiencies noted during performance of services which prevent system balance.

D. Beginning of work means acceptance of existing conditions of the installed system and equipment on the project.

3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

N. On fan powered VAV boxes, adjust airflow switches for proper operation.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.7 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing
   1. HVAC Pumps
   2. Packaged Boilers
   3. Safety Hood
   4. Air Cooled Refrigerant Condensers
   5. Packaged Roof Top Heating/Cooling Units
   6. Packaged Terminal Air Conditioning Units
   7. Unit Air Conditioners
   8. Computer Room Air Conditioning Units
   9. Air Coils
   10. Terminal Heat Transfer Units
   11. Induction Units
   12. Air Handling Units
   13. Fans
   14. Air Filters
   15. Air Terminal Units
   16. Air Inlets and Outlets

B. Report Forms
   1. Title Page
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone number of Testing, Adjusting, and Balancing Agency
      d. Project name
      e. Project location
      f. Project Architect
      g. Project Engineer
      h. Project Contractor
      i. Project altitude
      j. Report date
   2. Summary Comments
      a. Design versus final performance
      b. Notable characteristics of system
      c. Description of systems operation sequence
      d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
      e. Nomenclature used throughout report
      f. Test conditions, including weather conditions
   3. Instrument List:
      a. Instrument
      b. Manufacturer
      c. Model number
      d. Serial number
      e. Range
      f. Calibration date
   4. Electric Motors (all motor for all equipment):
      a. Manufacturer
      b. Model/Frame
      c. HP/BHP

   d. Phase, voltage, amperage; nameplate, actual, no load
   e. RPM
   f. Service factor
   g. Starter size, rating, heater elements
   h. Sheave Make/Size/Bore
5. V-Belt Drive:
   a. Identification/location
   b. Required driven RPM
   c. Driven sheave, diameter and RPM
   d. Belt, size and quantity
   e. Motor sheave diameter and RPM
   f. Center to center distance, maximum, minimum, and actual
6. Pump Data:
   a. Identification/number
   b. Manufacturer
   c. Size/model
   d. Impeller
   e. Service
   f. Design flow rate, pressure drop, BHP
   g. Actual flow rate, pressure drop, BHP
   h. Discharge pressure
   i. Suction pressure
   j. Total operating head pressure
   k. Shut off, discharge and suction pressures
   l. Shut off, total head pressure
7. Combustion Test:
   a. Boiler manufacturer
   b. Model number
   c. Serial number
   d. Firing rate
   e. Overfire draft
   f. Gas meter timing dial size
   g. Gas meter time per revolution
   h. Gas pressure at meter outlet
   i. Gas flow rate
   j. Heat input
   k. Burner manifold gas pressure
   l. Percent carbon monoxide (CO)
   m. Percent carbon dioxide (CO2)
   n. Percent oxygen (O2)
   o. Percent excess air
   p. Flue gas temperature at outlet
   q. Ambient temperature
   r. Net stack temperature
   s. Percent stack loss
   t. Percent combustion efficiency
   u. Heat output
8. Gas Fired Equipment
   a. Manufacturer
   b. Model number
   c. Serial number
   d. Firing rate
   e. Overfire draft
   f. BTUH at sea level
   g. BTUH at altitude
   h. Gas pressure at meter outlet
   i. Gas flow rate in cfh
   j. Heat input
   k. Burner manifold gas pressure
   l. Orifice size
   m. Air temperature rise for gas fired equipment
   n. Check all limit devices for proper operation, setting and calibration
   o. Make up water pressure setting
   p. Working pressure
   q. Ambient temperature
   r. Relief valve setting

   s. Static pressure
   t. Fan hydronic system and fan cfm
   u. Heat output
9. Air Cooled Condenser:
   a. Identification/number
   b. Location
   c. Manufacturer
   d. Model number
   e. Serial number
   f. Entering DB air temperature, design and actual
   g. Leaving DB air temperature, design and actual
   h. Number of compressors
10. Cooling Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Entering air DB temperature, design and actual
   g. Entering air WB temperature, design and actual
   h. Leaving air DB temperature, design and actual
   i. Leaving air WB temperature, design and actual
   j. Saturated suction temperature, design and actual
   k. Air pressure drop, design and actual
11. Heating Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Water flow, design and actual
   g. Water pressure drop, design and actual
   h. Entering water temperature, design and actual
   i. Leaving water temperature, design and actual
   j. Entering air temperature, design and actual
   k. Leaving air temperature, design and actual
   l. Air pressure drop, design and actual
12. Electric Heater:
   a. Manufacturer
   b. Identification/number
   c. Location
   d. Model number
   e. Design kW
   f. Number of stages
   g. Phase, voltage, amperage
   h. Test voltage (each phase)
   i. Test amperage (each phase)
   j. Air flow, specified and actual
   k. Temperature rise, specified and actual
13. Makeup Air Units
   a. Location
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Arrangement/Class/Discharge
   f. Air flow, specified and actual
   g. Return air flow, specified and actual
   h. Outside air flow, specified and actual
   i. Total static pressure (total external), specified and actual
   j. Inlet pressure
   k. Discharge pressure
   l. Sheave Make/Size/Bore
   m. Number of Belts/Make/Size
   n. Fan RPM
14. Air Moving Equipment
   a. Location

b. Manufacturer
c. Model number
d. Serial number
e. Arrangement/Class/Discharge
f. Air flow, specified and actual
g. Return air flow, specified and actual
h. Outside air flow, specified and actual
i. Total static pressure (total external), specified and actual
j. Inlet pressure
k. Discharge pressure
l. Sheave Make/Size/Bore
m. Number of Belts/Make/Size
n. Fan RPM

15. Return Air/Outside Air Data:
    a. Identification/location
    b. Design air flow
    c. Actual air flow
    d. Design return air flow
    e. Actual return air flow
    f. Design outside air flow
    g. Actual outside air flow
    h. Return air temperature
    i. Outside air temperature
    j. Required mixed air temperature
    k. Actual mixed air temperature
    l. Design outside/return air ratio
    m. Actual outside/return air ratio
16. Exhaust Fan Data:
    a. Location
    b. Manufacturer
    c. Model number
    d. Serial number
    e. Air flow, specified and actual
    f. Total static pressure (total external), specified and actual
    g. Inlet pressure
    h. Discharge pressure
    i. Sheave Make/Size/Bore
    j. Number of Belts/Make/Size
    k. Fan RPM
    l. Motor data
    m. Electrical data
17. Duct Traverse (includes main ducts and main branches):
    a. System zone/branch
    b. Duct size
    c. Area
    d. Design velocity
    e. Design air flow
    f. Test velocity
    g. Test air flow
    h. Duct static pressure
    i. Air temperature
    j. Air correction factor
18. Duct Leak Test:
    a. Description of ductwork under test
    b. Duct design operating pressure
    c. Duct design test static pressure
    d. Duct capacity, air flow
    e. Maximum allowable leakage duct capacity times leak factor
    f. Test apparatus
        1) Blower
        2) Orifice, tube size
        3) Orifice size
        4) Calibrated
    g. Test static pressure
    h. Test orifice differential pressure
    i. Leakage

19. Terminal Unit Data (VAV boxes, Bypass boxes, etc.):
    a. Manufacturer
    b. Type, constant, variable, single, dual duct
    c. Identification/number
    d. Location
    e. Model number
    f. Size
    g. Minimum static pressure
    h. Minimum design air flow
    i. Maximum design air flow
    j. Maximum actual air flow
    k. Inlet static pressure
    l. Model number
    m. Size of hood
    n. Design CFM
    o. Number of filters
    p. Duct velocity
    q. Filter velocity
    r. Type of filter
    s. Interlock with makeup air unit
20. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/location
    c. Terminal type
    d. Terminal size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow
21. Sound Level Report (occupied spaces):
    a. Location
    b. Octave bands - equipment off
    c. Octave bands - equipment on
22. Vibration Test:
    a. Location of points:
        1) Fan bearing, drive end
        2) Fan bearing, opposite end
        3) Motor bearing, center (if applicable)
        4) Motor bearing, drive end
        5) Motor bearing, opposite end
        6) Casing (bottom or top)
        7) Duct after flexible connection (discharge)
        8) Duct after flexible connection (suction)
    b. Test readings:
        1) Horizontal, velocity and displacement
        2) Vertical, velocity and displacement
        3) Axial, velocity and displacement
    c. Normally acceptable readings, velocity and acceleration
    d. Unusual conditions at time of test
    e. Vibration source (if non-complying)

3.8 CALCULATIONS

A. The following calculations shall be made and become part of the reported data.
    1. The CFM at each heating, cooling, and fan coil, the heating and/or cooling capacity of each and the air temperature change of each.
    2. The water flow at each heating, the heating and/or cooling capacity of each and the water temperature change of each.
    3. The fuel flow to each gas fired unit and the BTUH input.
    4. The capacity of each refrigeration unit in BTUH or tons at full capacity and at each unloaded step.

3.9 OPERATING TEST

A. The test and balance agency shall coordinate and set up an operating test when Test & Balance is completed to ensure complete operation of the system in all modes. The controls contractor, sheet metal trade and the general contractor shall certify in writing test completion and all units are operating as designed. Attach copy of operating test to Test & Balance report.

END OF SECTION

SECTION 23 07 13 DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and Install
   1. Ductwork insulation.
   2. Duct liner.
   3. Insulation jackets.

1.2 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section

1.3 DESCRIPTION OF WORK

A. Work Included: The work included by this specification consists of furnishing all labor, accessories, equipment, and materials necessary for the installation of all insulation for ductwork and mechanical equipment in accordance with the specification and applicable drawings. This includes but is not limited to:
   1. All supply ductwork
   2. Return ductwork not within the conditioned space
   3. All ductwork in the mechanical room
   4. Outside air inlet ductwork that is within the conditioned space.
   5. Mechanical equipment not factory insulated.

B. Do not internally insulate ductwork from evaporative coolers unless specifically indicated on the drawings.

C. Exterior duct wrap insulation with vapor barrier shall be used on all outdoor air ductwork within conditioned spaces.

D. Supply and return air ductwork shall be insulated with duct liner except in air handling systems having air washers or humidifiers. Where air washers or humidifiers are used, exterior duct insulation shall be used. Where duct liner is used, dimensions shown on the drawings shall be clear inside duct liner.

E. Testing:
   1. All ductwork and mechanical equipment shall be tested for leakage and approved by the Architect/Engineer before any insulation is applied. The insulation contractor shall have this verified in writing before beginning work.

1.4 RELATED WORK IN OTHER SECTIONS

09 90 00	PAINTING: PAINTING INSULATION JACKETS.
23 00 00	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 30 00	AIR DISTRIBUTION

1.5 REFERENCES

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

D. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

E. ASTM E84 - Surface Burning Characteristics of Building Materials.

F. ASTM E96 - Water Vapor Transmission of Materials.

G. NFPA 255 - Surface Burning Characteristics of Building Materials.

H. SMACNA - HVAC Duct Construction Standards 1985 Ed. - Metal and Flexible.

I. UL 723 - Surface Burning Characteristics of Building Materials

1.6 DEFINITIONS

A. Exposed Location: Exposed in mechanical rooms or rooms with finished walls or ceilings.

B. Concealed Location: Located in pipe chase, furred spaces, attics, crawl spaces, above suspended ceilings in finished and unfinished rooms, or all other locations not exposed to view.

C. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. K Factors: All K Factors shown in the following specifications are expressed in BTU-in/hr-sq.ft-F.

1.7 SUBMITTALS

A. General: Comply with Section 230500.

B. Product Data: Provide product description, list of materials and thickness for each service, and locations.

C. Manufacturer's Installation Instructions: Indicate procedures, which ensure acceptable workmanship and installation standards will be achieved.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements Fire Hazard Classification: Insulation shall have a composite (insulation, jacket or facing, and adhesive to secure jacket or facing) fire hazard rating as tested by ASTM E84, NFPA 255, or UL 723 not to exceed 25 flame spread, 50 fuel contribution, and 50 smoke development. Materials shall be labeled accordingly.

B. Certifications of Insulation and Covering Materials: UL listed; flame spread/fuel contributed/smoke development rating of 25/50 in accordance with ASTM E84, NFPA 255, and UL 723.

1.9 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum five years of documented experience.

1.10 DELIVERY, STORAGE AND HANDLING

A. General Requirements: Comply with Section 230500. Deliver materials to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness. Store in a warm, dry location and protect against dirt, water, chemical, and mechanical damage.

1.11 PROJECT CONDITIONS

A. Manufacturer's Requirements: Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation while in storage.

B. Environmental Requirements: Perform work at ambient and equipment temperatures as recommended by the insulation manufacturer.

C. Protection: Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Repair or replace any such insulation or covering damaged prior to final acceptance of work.

1.12 WARRANTY

A. General: Satisfy requirements of Section 23 05 00 - GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Owens-Corning Fiberglass Corporation.
   2. Knauf.
   3. Certainteed.
   4. Manville.

2.2 INSULATION MATERIALS

A. Glass Fiber, Flexible:
   1. Insulation: ASTM C553; flexible, noncombustible blanket.
      a. 'K' value: ASTM C518, of 0.29 at 75 degrees F.
      b. Maximum service temperature: 250 degrees F.
      c. Maximum moisture absorption: 0.20 percent by volume.
      d. Density: 0.75 lb/cu ft.
   2. Vapor Barrier Tape:
      a. Kraft paper reinforced with glass fiber yarn and bonded to aluminum film.
   3. Tie Wire: Annealed steel, 16 gauge.

B. Glass Fiber, Rigid:
   1. Insulation: ASTM C612; rigid, noncombustible blanket.
      a. 'K' value: ASTM C518, of 0.29 at 75 degrees F.
      b. Maximum service temperature: 250 degrees F.
      c. Maximum moisture absorption: 0.20 percent by volume.
      d. Density: 0.75 lb/cu ft.
   2. Vapor Barrier Jacket:
      a. Kraft paper reinforced with glass fiber yarn and bonded to aluminum film.
      b. Moisture vapor Transmission: ASTM E96; 0.04 perm.
      c. Secure with pressure sensitive tape.
   3. Vapor Barrier Tape:
      a. Kraft paper reinforced with glass fiber yarn and bonded to aluminum film, with pressure sensitive rubber based adhesive.

C. Glass Fiber Duct Liner, Flexible
   1. Insulation: ASTM C553; flexible, noncombustible blanket.
      a. 'K' value: ASTM C518, of 0.28 at 75 degrees F.
      b. Maximum service temperature: 250 degrees F.
      c. Density: 2.0 lb/cu ft.
      d. Maximum Velocity on Coated Air Side: 4000 ft/min.
   2. Adhesive
      a. Waterproof, fire-retardant type.
   3. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

D. Glass Fiber Duct Liner, Rigid:
   1. Insulation: ASTM C612; flexible, noncombustible.
      a. 'K' value: ASTM C518, of 0.23 at 75 degrees F.
      b. Maximum service temperature: 250 degrees F.
      c. Density: 2.0 lb/cu ft.
      d. Maximum Velocity on Coated Air Side: 4000 ft/min.
   2. Adhesive:
      a. Waterproof, fire-retardant, type.
   3. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

2.3 JACKETS

A. Canvas Jackets: UL listed.
   1. Fabric: 6 oz/sq yd, plain weave cotton treated with dilute fire-retardant lagging adhesive.
   2. Lagging Adhesive: Compatible with insulation.

B. Aluminum Jacket: ASTM B209.
   1. Thickness: 0.025-inch sheet.
   2. Finish: Smooth or Corrugated.
   3. Joining: Longitudinal slip joints and 2-inch laps.
   4. Fittings: 0.016-inch-thick die shaped fittings covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8-inch wide, 0.016-inch-thick aluminum.
   6. Flexible glass fiber with fire resistant coating facing air stream; ASTM E84/ASTM C518-70; 'k' value of 0.25 maximum at 75 F, 2 lb. density, one-inch thickness.

C. Type C: Neoprene faced, rigid glass fiberboard, 2 lb. density, ASTM E84/ASTM C518; 'k' value of 0.23 at 75 degrees F; one-inch thickness.

D. Jackets:
   1. Interior Applications
      a. Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints.
   2. Exterior Applications
      a. Sheet metal enclosure of corrugated aluminum, 0.02 in. thick, with metal jacket bands: 3/8 inch wide, 0.016 thick aluminum; or stick clips with smooth finish.

2.4 ACCESSORIES

A. Impale Anchors: Galvanized steel, 12-gauge, self-adhesive pad and press on washer head.

B. Joint Tape: Glass fiber cloth, open mesh.

C. Lagging Adhesive: Fire resistive to ASTM E-84 or NFPA 255 or UL 723.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that ductwork has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. General
   1. Applications: Apply insulation tightly over clean, dry surfaces with sections or edges firmly butted together or lapped. Make insulation continuous through sleeves or openings in walls or floors.
   2. Vapor Barriers: Seal vapor barriers and run continuous throughout for heated and cooled supply air ductwork.
   3. Finishes: Finish insulation neatly at hangers, supports and other protrusions. Locate insulation or cover seams in least visible locations.
   4. Installation Repairs: Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
   5. Exterior Locations: Re-cover with corrugated aluminum jacket attached with suitable aluminum rivets.
   6. Manufacturer's Instructions: Install materials in accordance with manufacturer's instructions.
   7. Thermal Units: Provide insulation with vapor barrier on ductwork downstream of fan coil terminal units.
   8. Factory Insulated Equipment: Do not insulate factory-insulated equipment.
   9. Attachment: Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
   10. Cement and Fillers: Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

11. Placards: Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such nameplate or any operable device.
12. Service Access: When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
13. Insulation shall be installed in a workmanlike manner by workmen regularly engaged in this type of work. Insulation shall not be applied until all surfaces are clean and dry and until inspection and release for insulation application.
14. A complete moisture and vapor seal shall be provided on cold surfaces where vapor barrier jackets or coatings are required. Anchors, hangers and other projections shall be insulated and vapor sealed to prevent condensation.
15. Duct insulation shall be continuous through walls and floor openings except where walls or floors are required to be fire stopped or required to have a fire resistance ratings.

B. Locations for Insulation:
1. External: Outside of ducts not internally lined, located interior of building, in mechanical room.
   a. Rectangular: 1-1/2-inch thick glass fiber insulation. Fasten to duct with weld pins or stock clips spaced 12 inches to 18 inches o.c. with minimum of two rows per side of duct. Secure with washers firmly embedded in insulation. Seal joints, breaks, and punctures in cold air ductwork wire fire-retardant vapor adhesive reinforced with a three-inch wide strip similar to that of facing.
   b. Round: Two-inches thick glass fiber blanket duct wrap. Adhere insulation to duct with fire retardant adhesive applied in bands around the duct. Butt tight with facing overlapping all joints at least two inches. Seal cold air ductwork with fire retardant vapor barrier adhesive. Seal breaks and punctures in the facing of cold air ductwork with vapor barrier tape sealed with fire retardant adhesive.
2. For exterior applications, provide insulation with vapor barrier jacket w/2” thick rigid insulation w/minimum R-value of 8. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
3. Insulation below grade shall be polyurethane spray foam, suitable for use in wet environments without degradation and having the following properties.
   a. All duct shall be supported on 2” thick rigid polystyrene board exceeding the width of the duct. Spray foam shall be applied to assure a 2” MINIMUM coverage. Insulation shall be coated with Deer-O Foam Cap W-256 applied at the rate of one gallon per 100 square ft. for vapor barrier protection with a perm rating of 0.00019.

C. Duct Liner
1. Duct liner shall be installed in accordance with Figures 6-1 through 607 of the SMACNA High Velocity Duct Manual and the Manufacturer’s recommendations.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 23 08 00 COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The purpose of this section is to specify the Division 23 responsibilities and participation in the Commissioning Process and to conform to NM Energy Code requirements.

B. Work under this contract shall conform to requirements of Division 01, General Requirements, Conditions of the Contract, and Supplementary Conditions. This specification covers commissioning of mechanical systems which are part of this project.

C. Commissioning work shall be a team effort to ensure that all mechanical equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and document system performance. Commissioning shall coordinate system documentation, equipment start-up, control system calibration, testing and balancing, and verification and performance testing.

D. The Commissioning Team shall be made up of representatives from the owner, Design Team, General Contractor (GC), manufacturers, and construction trades. The trades represented on the Commissioning Team shall include, but not be limited to: sheet metal, piping and fitting, controls, test and balance, and electrical. The lead person for each trade who will actually perform or supervise the work is to be designated as the representative to the Commissioning Team. Responsibility for various steps of the Commissioning Process shall be divided among the members of the Commissioning Team, as described in this section.

E. The Commissioning Authority (CxA) shall have responsibility for coordinating and directing each step of the Commissioning Process.

F. Mechanical system installation, start-up, testing, balancing, preparation of O&M manuals, and operator training are the responsibility of the Division 23 Contractors, with coordination, observation, verification and commissioning the responsibility of Division 01-. The Division 01 Commissioning Process does not relieve Division 23 from the obligations to complete all portions of work in a satisfactory and fully operational manner.

G. Refer to Division 01 for a full list of commissioning requirements. A few critical definitions are included below:
   1. *Commissioning*. A systematic process that provides documented confirmation that specific and interconnected fire and life safety systems function according to the intended design criteria set forth in the project documents and satisfy the owner's operational needs, including compliance requirements of any applicable laws, regulations, codes, and standards requiring fire and life safety systems.
   2. *Commissioning Authority (CxA*). The qualified person, company, or agency that plans, coordinates, and oversees the entire Cx process.
   3. *Commissioning Plan*. The document prepared for each project, which identifies the processes and procedures necessary for a successful Cx process.
   4. *Commissioning Record*. The complete set of commissioning documentation for the project, which is turned over to the owner at the end of the construction phase.
   5. *Functional Testing*. Tests performed to verify compliance with manufacturers' specifications, applicable codes and standards, and the project BOD and OPR.

1.2 RELATED SECTIONS

A. Division 01 Section 01 91 13 - General Commissioning Requirements

B. Division 22 Section 22 08 00 - Commissioning of Plumbing Systems

C. Division 26 Section 26 08 00 - Commissioning of Electrical Systems

D. Division 27 Section 27 08 00 - Commissioning and Acceptance

E. Individual Division 01, 21, 22, 23, 25, and 26 sections contain requirements related to the commissioning process.

1.3 ROLES AND RESPONSIBILITIES

A. Refer to Section 01 91 13 for Commissioning Authority, Owner, Architect, and General Contractor roles and responsibilities.

B. Refer to Section 22 08 00 for plumbing contractor roles and responsibilities.

C. Refer to Section 26 08 00 for electrical contractor roles and responsibilities.

D. Refer to Section 27 05 00 for communications contractor roles and responsibilities.

E. Design Team
1. Provide documentation of initial design concepts and Design Intent based on Owner's program.
2. Provide mechanical system design parameters and obtain approval of Owner.
3. Prepare contract documents incorporating Commissioning Specification requirements and description of the electrical systems.
4. The Design Team shall specify and verify adequate maintenance accessibility for each piece of equipment in shop drawings and the actual installation.
5. Periodic inspections as part of the Design Team's contract with the Architect and/or Owner.
6. Review and approve submittals.
7. Participate in commissioning meetings.
8. Review Pre-functional Checklists and Functional Performance Test procedures submitted by the Commissioning Authority.
9. Prepare punch lists.
10. Review as-built records as required by contract documents. Issue a report noting deficiencies requiring correction to the Commissioning Authority.
11. Review and comment on final commissioning report.

F. Mechanical Contractor
1. Include cost to complete commissioning requirements for mechanical systems in the contract price.
2. Include requirements for submittal data, O&M data, and training in each purchase order or subcontract written.
3. Ensure cooperation and participation of all subcontractors.
4. Ensure participation of major equipment manufacturers in appropriate training and testing activities.
5. Attend Construction Phase coordination meeting scheduled by the Commissioning Authority.
6. Conduct mechanical system orientation and inspection when equipment is set.
7. Respond to (in writing) and address items documented in the Contractor Commissioning Issues Log.
8. Notify the GC a minimum of two weeks in advance of system start-up and testing, so CxA may be on site to witness.
9. Notify the GC a minimum of two weeks in advance, of the time for start of the TAB work. Attend the initial TAB meeting for review of the TAB procedures.
10. Submit copies of all test results to the CxA.
11. Complete Pre-Functional Checklists for all equipment.
    a. If no other system is agreed upon by Commissioning Team, Mechanical Contractor shall be responsible for completion of Pre-Functional Checklists for all equipment for which it issued a purchase order.
    b. Mechanical Contractor shall coordinate completion of Pre-Functional Checklists with all other contractors that have made connections to equipment for which it issued a purchase order.
    c. Remedy any deficiencies identified in Pre-Functional Checklists and notify CxA in writing that deficiencies have been addressed.
12. Assist the Commissioning Authority in all Pre-Functional Checklist verifications and Functional Performance Tests.
13. Prepare preliminary schedule for mechanical system orientation and inspections, O&M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start up, TAB, and task completion for use by the GC and Commissioning Authority. Update schedule as appropriate throughout the construction period.
14. Conduct mechanical system orientation and inspection when equipment is set in place.
15. Keep drawings updated as changes in the field are made, and review with the GC and Commissioning Authority.
16. Gather O&M data on all equipment, and assemble in binders as required by the Commissioning Specification. Submit to GC for review prior to the completion of construction.
17. Participate in, and schedule vendors and Contractors to participate in the training sessions as set up by the GC.
18. Provide written notification to the General Contractor and Commissioning Authority that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-systems are functioning as required.
    a. HVAC equipment including all fans, air handling units, dehumidification units, ductwork, dampers, terminals, and all Division 23 equipment.
    b. Refrigeration equipment, pumping systems and heat rejection equipment.

c. Fire stopping in the fire rated construction, including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
d. Fire detection and smoke detection devices furnished under other divisions of this specification as they affect the operation of the smoke control systems.
e. That building control systems are functioning to control mechanical equipment and smoke control system per control diagrams.

19. Submit training syllabus for approval to Commissioning Authority.
20. Participate in, and schedule vendors and Contractors to participate in the training sessions as set up by the GC. Provide site-specific training information on digital media/electronic format (flash drive, CD, DVD). If training is videotaped, provide on digital media/electronic format (flash drive, CD, DVD).
21. Provide a complete set of as-built records to the GC. Hard Copy and Electronic Format (Flash Drive, CD, DVD, email, Dropbox, etc….) are required.

G. Test, Adjust, and Balance Contractor
1. Include cost for commissioning requirements in the contract price.
2. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
3. Submit the TAB procedures to the GC for review and acceptance.
4. Attend the TAB review meeting scheduled by the GC. Be prepared to discuss the procedures that shall be followed in testing, adjusting, and balancing the HVAC system.
5. Participate in training sessions as scheduled by the GC.
6. At the completion of the TAB work, and submittal of final TAB report, notify the Mechanical Contractor.
7. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the Commissioning Authority for verification or diagnostic purposes.

H. Integrated Automation Contractors
1. Include cost for commissioning requirements in the contract price, including assisting the Commissioning Authority with implementation of Functional Test Procedures and reviewing control system operation with the Commissioning Authority.
2. Review design for controllability with respect to selected manufacturer's equipment:
   a. Verify proper hardware specification exists for functional performance required by specification and sequence of operation.
   b. Verify proper safeties and interlocks are included in design.
   c. Verify proper sizing of control valves and actuators based on design pressure drops. Verify control valve authority to control coil properly.
   d. Verify proper sizing of control dampers. Verify damper authority to control air stream. Verify proper damper positioning for mixing to prevent stratification. Verify actuator vs. damper sections for smooth operation.
   e. Verify proper selection of sensor ranges.
   f. Clarify all questions of operation.
3. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
4. Provide the following submittals to the GC:
   a. Hardware and software submittals.
   b. Control panel construction shop drawings.
   c. Narrative description of each control sequence for each piece of equipment controlled.
   d. Diagrams showing all control points, sensor locations, point names, actuators, controllers and, where necessary, points of access, superimposed on diagrams of the physical equipment.
   e. Logic diagrams showing the logic flow of the system.
   f. A list of all control points, including analog inputs, analog outputs, digital inputs, and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each stand-alone control unit.
   g. A complete control language program listing including all software routines employed in operating the control system. Also provide a program write-up, organized in the same manner as the control software. This narrative shall describe the logic flow of the software and the functions of each routine and sub-routine. It should also explain individual math or logic operations that are not clear from reading the software listing.
   h. Hardware operation and maintenance manuals.
   i. Application software and project applications code manuals.
5. Verify proper installation and performance of controls/BAS hardware and software provided by others.
6. Integrate installation and programming schedule with construction and commissioning schedules.
7. Provide thorough training to operating personnel on hardware operations and programming, and the application program for the system.
8. Demonstrate system performance to Commissioning Authority including all modes of system operation (e.g., normal, abnormal, and emergency).

9. Provide control system technician for use during Pre-Functional Checklists and Functional Performance Testing.
10. Provide system modifications as required.
11. Provide support and coordination with TAB contractor on all interfaces between their scopes of work. Provide all devices, such as portable operator terminals, for TAB use in completing TAB procedures.
12. Provide trend logs as required to facilitate the Commissioning Process.

I. Equipment Manufacturers and Miscellaneous Contractors
1. Include cost for commissioning requirements in the contract price.
2. Provide submittals, and appropriate O&M manual section(s).
3. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
4. Participate in training sessions as scheduled by the GC.
5. Demonstrate performance of equipment as applicable.

1.4 SCOPE OF WORK

A. Commissioning work of Division 23 shall include, but not be limited to:
1. Testing and start-up of the equipment.
2. Logging in and checking the WCxS at least once a week for outstanding items.
3. Completion of Pre-Functional Checklists on the WCxS.
4. Testing, adjusting, and balancing of hydronic and air systems.
5. Cooperation with the Commissioning Authority.
6. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial testing.
7. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the Commissioning Process.
8. Providing operation and maintenance manuals and as-built drawings to the Commissioning Authority for verification.
9. Providing training and demonstrations for the systems specified in this Division.

B. The work included in the Commissioning Process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be evaluated:
1. Air Handling Units
2. Heat exchangers and associated pumps
3. Unit heaters
4. Variable air volume terminals
5. Temperature control systems
6. Refrigeration systems
7. Air distribution systems, including ductwork, fittings, insulation, fire dampers, diffusers, grilles, balancing dampers, sound attenuators, etc.
8. Hydronic distribution systems, including piping, valves, fittings, insulation, air separators, expansion tanks, etc.
9. Fire alarm and fire protection devices.
10. Fire alarm interface with HVAC, life safety and elevators.

C. Timely and accurate documentation is essential for the Commissioning Process to be effective. Documentation required as part of the Commissioning Process shall include but not be limited to:
1. Commissioning Process Reports, which may include the following:
   a. Commissioning Field Reports
   b. Design Team Issues Log
   c. Contractor Commissioning Issues Log from the WCxS
   d. Meeting Minutes
2. Pre-start, and start-up procedures
3. Pre-Functional Checklists on the WCxS
4. Functional Performance Tests on the WCxS
5. Training agenda and materials
6. As-built records
7. Final commissioning report
8. Operation and maintenance (O&M) manuals

D. Detailed testing maybe performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. All tests shall be witnessed by the Commissioning Authority. The following testing is required as part of the Commissioning process:
1. Pre-Functional Checklists (PFC) are comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract

documents. Verification is completed by the Division 22, 23 and 26 contractors and documented using Pre-Functional Checklists.

2. Functional Performance Tests (FPT) shall determine if the HVAC system is operating in accordance with the design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.

E. Comprehensive training of O&M personnel shall be performed by the Mechanical Contractor, and where appropriate, by other sub-contractors, and vendors prior to turnover of building to the owner. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems.

1.5 DOCUMENTATION

A. The Commissioning Authority shall oversee and maintain the development of the document process. The GC shall facilitate project documentation through the web-based commissioning software. The commissioning documentation shall include, but not be limited to, the following:
1. Commissioning Plan
2. Commissioning Schedule
3. Document Request Log
4. Commissioning RFIs
5. Commissioning Field Reports on the WCxS
6. Design Team Issues Log on the WCxS
7. Contractor Commissioning Issues Log on the WCxS
8. Pre-Functional Checklists on the WCxS
9. Functional Performance Tests on the WCxS
10. See 01 91 13 for additional information on the commissioning documentation.

B. See 01 91 13 for additional information on the commissioning documentation.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The appropriate Contractor(s) shall furnish all special tools and equipment required for testing during the commissioning process. A list of all tools and equipment to be used during commissioning shall be submitted to the Commissioning Authority for approval. The owner shall furnish necessary utilities for the Commissioning Process.

2.2 TEST EQUIPMENT – PROPRIETARY

A. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the Commissioning Process as needed. Proprietary test equipment (and software) shall become the property of the owner upon completion of the Commissioning Process.

PART 3 - EXECUTION

3.1 GENERAL

A. A pre-construction meeting of all Commissioning Team members shall be held at a time and place designated by the owner. The purpose shall be to familiarize all parties with the Commissioning Process, and to ensure that the responsibilities of each party are clearly understood.

B. The Contractor shall complete all phases of work so the systems can be started, tested, balanced, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.

C. A Commissioning Plan shall be developed by the Commissioning Authority. The Contractor shall assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If contractor-initiated system changes have been made that alter the Commissioning Process, the Commissioning Authority shall notify the Owner.

D. The Contractor is to complete the Work in a sequence that allows for systemic and holistic functional testing rather than piecemeal testing. This includes BAS and SCADA integration.

E. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems and shall be coordinated with the Division 23 contractor. Start of acceptance procedures before system completion does not relieve the contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

A. The Contractor shall provide skilled technicians to start-up and debug all systems within Division 15. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the Commissioning Authority and coordinated by the contractor. Contractor shall ensure that the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

B. System performance problems and discrepancies may require additional technician time, Commissioning Authority time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.

C. The Commissioning Authority reserves the right to question the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians shall include expert knowledge relative to the specific equipment involved and a willingness to work with the Commissioning Authority. Contractor shall provide adequate documentation and tools to start up and test the equipment, system, and/or sub-system.

3.3 DEFICIENCY RESOLUTION

A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the Owner, with input from the contractor, equipment manufacturer, and Commissioning Authority. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Owner shall make final determination over any additional required work to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit the completion of the Commissioning Process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the Commissioning Process, the Commissioning Authority shall notify the Owner, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner shall be the contractor's responsibility.

C. The Owner's contract with the Commissioning Authority includes up to two Functional Performance Tests of each piece of equipment or system included in the commissioning scope. Commissioning Authority time and expenses required for retests beyond two, if required, due to incomplete installation or otherwise, will be paid by the Owner and reimbursed by the contractor.

3.4 ADDITIONAL COMMISSIONING

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The contractor(s), manufacturers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their contractual obligations.

3.5 SEASONAL COMMISSIONING

A. Seasonal commissioning pertains to testing under full load conditions during peak heating and peak cooling seasons, as well as part load conditions during off-peak periods. Initial commissioning shall be done as soon as contract work is completed, regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different peak and off-peak conditions. Each contractor and manufacturer shall be responsible to participate in the initial and the alternate peak and off-peak tests of the systems as required to demonstrate performance.

3.6 CONSTRUCTION PHASE OBSERVATION

A. Scope of Construction Phase Observation

1. The Commissioning Authority will conduct periodic observations during the Construction Phase to monitor progress and compliance with the design intent and contract documents. It is the responsibility of the contractor to address the issues noted on the Issues Log and notify Commissioning Authority of completion.
2. Commissioning Authority observations will coincide with Design Team observations and are not intended to take the place of this work.

B. Documentation and Reporting
1. Issues identified by the Commissioning Authority during Construction Phase will be documented on the WCxS and distributed to Commissioning Team members.
2. Progress during the Construction Phase will also be documented by the Commissioning Authority using Commissioning Process Reports.

3.7 ACCEPTANCE PROCEDURES

A. Pre-Functional Checklists
1. Pre-Functional Checklist Scope
   a. Tests and verifications included in the Pre-Functional Checklists shall determine if all components, equipment, systems, and interfaces between systems are installed and are ready to operate in accordance with contract documents.
2. Pre-Functional Checklist Roles and Responsibilities
   a. The Commissioning Authority shall be responsible for creating the Checklists, which will be completed by the installing contractors and then verified (via spot checking and Functional Performance Testing). Participating contractors, manufacturers, etc. shall include all costs to do the work involved in these tests in their proposals. The following is a list of tasks and supporting information that shall be required:
   b. The Mechanical Contractor shall provide the services of a technician(s) who is (are) familiar with the construction and operation of the applicable system. Provide access to the contract plans, shop drawings, and equipment cut sheets of all installed equipment.
   c. The controls contractor shall provide the services of a controls engineer who is familiar with the details of the project. Provide details of the control system, schematics, and a narrative description of control sequences of operation.
   d. The electrical contractor shall provide a foreman electrician familiar with the electrical interlocks, interfaces with emergency power supply, and interfaces with alarm and life-safety systems. Provide access to the contract plans, and all as-built schematics of sub-systems, interfaces, and interlocks.
3. Documentation and Reporting Requirements
   a. Pre-Functional Checklists shall be provided for each component, piece of equipment, system, and sub-system, including all interfaces, interlocks, etc. Each item to be tested shall have a different entry line with space provided for comments. The checklists will include spaces for each party to sign off on.
   b. Completed checklists shall be submitted to the Commissioning Authority for acceptance and inclusion in the commissioning report.
4. Acceptance of Pre-Functional Checklists
   a. The Commissioning Authority will select, at random, 10 percent of the checklists for verification.
   b. If 10 percent or more of the checklists are found to be inaccurate for each system or equipment type, all of the checklists for that system or equipment type will be rejected. Complete, accurate checklists will need to be resubmitted.

B. Test, Adjust, and Balance Verification
1. The Commissioning Authority shall select, at random, 10 percent of the report data for verification.
2. The TAB contractor shall be given sufficient advance notice of the date of field verification. However, they shall not be informed in advance of the data points to be verified.
3. Failure of an item is defined as:
   a. For all readings other than sound, a deviation of more than 10 percent.
   b. For sound pressure readings, a deviation of 3 decibels. (Note: variations in background noise must be considered).
4. A failure of more than 10 percent of the selected items shall result in the rejection of the final TAB report.

C. Functional Performance Testing
1. Scope of Functional Performance Testing
   a. Functional Performance Tests shall determine if equipment, system, and/or sub- system is operating in accordance with the final design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions. The following is a list of test examples:

1) Determine capability of chilled water system to deliver chilled water at the design supply temperature, and required rate of flow.
2) Determine capacity of electric heating system to deliver heating at the design temperature.
3) Determine the ability of the HVAC unit to deliver the cooling and/or heating services to the distribution system, at the design supply air temperature, required static pressure, and proper outside air ventilation rate.

2. Functional Performance Test Report
   a. Detailed procedures for each series of tests will be developed by the Commissioning Authority for review and acceptance by the GC and Owner. The procedures shall include samples of the data sheets that will be part of the reports.
   b. The Funtional Performance Test Report will be integrated as part of the WCxS.
3. Participants in Functional Performance Tests
   a. Participants in the Functional Performance Tests shall be the same as those listed in the Pre-Functional Checklists.
4. Functional Performance Test Procedures
   a. The Commissioning Authority shall supervise and direct all Functional Performance Tests.
      1) Set the system equipment (i.e., chiller, boiler, pumps, fans, etc.) into the operating mode to be tested (i.e., normal shut-down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
      2) The Commissioning Authority shall inspect and verify the position of each device and interlock identified in the test procedure. Each item shall be signed off as acceptable (yes) or failed (no).
      3) This test shall be repeated for each operating cycle that applies to the mechanical system being tested.
      4) Operating checks shall include all safety cutouts, alarms, and interlocks with smoke control and life safety systems during all modes of operation of the mechanical system.
      5) If during a test an operating deficiency is observed, appropriate comments will be added to the Test Procedure form and the Issues Log.
      6) Confirmation of the TAB results shall be verified utilizing the Building Automation System. This shall include, but not be limited to, the following:
         (a) Verify supply and return flow rates for VAV and constant volume systems in all modes of operation of the HVAC system.
         (b) Verify operation of the terminal units in both heating and cooling cycles.
         (c) Verify minimum outdoor air intake in all modes of operation and at minimum and maximum total airflow rates.
         (d) Verify building pressurization.
         (e) Verify total exhaust airflow, and total outdoor air intake.

      7) Verification of the proper responses of BAS system controllers and sensors shall be as follows:
         (a) For each controller or sensor, record the indicated BAS system reading, and the test instrument reading.
         (b) If the initial test indicates that the test reading is outside of the control range of the installed device, the calibration of the installed device shall be checked and adjusted as required. The deficient device shall be re-tested and the results recorded on the Functional Performance Test form on the WCxS.
   b. If deficiencies are identified during Functional Performance Testing, the General Contractor will be notified, and action taken to remedy the deficiency. The final Functional Test Procedure forms will be reviewed by the Commissioning Authority to determine if testing is complete and the system is functioning in accordance with the contract documents.
5. Documentation and Reporting Requirements
   a. All measured data, data sheets, and a comprehensive summary, describing the operation of the HVAC system at the time of testing shall be submitted to the Commissioning Authority.
   b. A preliminary Functional Performance Test report shall be prepared by the Commissioning Authority and submitted to the Design Team for review. Any identified deficiencies need to be evaluated by the Design Team and General Contractor to determine if they are part of the contractor's or sub-contractor's contractual obligations. Construction deficiencies shall be corrected by the responsible contractor(s), and the specific Functional Performance Test repeated.
   c. If it is determined that the HVAC system is constructed in accordance with the contract documents, and the performance deficiencies are not part of the contract documents, the Owner must decide whether any required modifications needed to bring the performance of the HVAC system up to the finalized design intent shall be implemented, or if the test shall be accepted as submitted. If corrective work is performed, the owner shall determine if a portion or all required Functional Performance Tests should be repeated, and a revised report submitted.

3.8 SYSTEMS MANUAL

A. The Systems Manual shall be submitted in paper and/or electronic format and shall contain the following major sections:
   1. System Descriptions:
      a. Each major system shall be described, typewritten, in general terms, including major components, interconnections, theory of operation, theory of controls, unusual features and major safety precautions. This information should correlate with information provided in the manufacturers' instructions book. This section shall include, but not be limited to, the following data:
         1) Detailed description of each system and each of its components showing piping, valves, controls, and other components, with diagrams and illustrations where applicable.
         2) Wiring and control diagrams with data to explain detailed operation and control of each component.
         3) Control sequences describing start-up, all modes of operation, and shut down.
         4) Corrected shop drawings.
         5) Approved product data including all performance curves and rating data.
         6) Copies of approved certifications and laboratory or factory test reports (where applicable).
         7) Copies of warranties.
      b. System diagrams, described in the following section, shall be incorporated in the appropriate systems descriptions. These should be reduced in size or folded to usefully fit into the manual.
   2. Operating Instructions:
      a. Condensed, typewritten, suitable for posting, instructions shall be provided for each major piece of equipment. Where more than one (1) common unit is installed, one instruction is adequate. The instructions shall provide procedures for:
         1) Starting up the equipment/system
         2) Shutting down the equipment/system
         3) Operating the equipment in emergency or unusual conditions
         4) Safety precautions
         5) Trouble shooting suggestions
         6) Other pertinent data applicable to the operation of particular systems or equipment
      b. The instructions shall be suitable for posting adjacent to the equipment concerned.
      c. The contractor shall provide instructions for (at minimum):
         1) Air Handling Units
         2) HVAC pumps
         3) Boilers
         4) Heating hot water pumps
         5) Make-up air units
         6) Classroom and lab exhaust
         7) Variable air volume terminals
         8) Temperature control systems
         9) Air and hydronic test and balance
         10) Air distribution systems, including ductwork, fittings, insulation, fire dampers, diffusers, grilles, balancing dampers, sound attenuators, etc.
         11) Hydronic distribution systems, including piping, valves, fittings, insulation, air separators, expansion tanks, etc.
         12) Domestic hot water heaters
   3. Ongoing and Preventive Maintenance:
      a. Condensed, typewritten procedures for recommended ongoing and preventive maintenance actions shall be provided for each category of equipment/system listed above. This information shall include, but not be limited to the following:
         1) Maintenance and overhaul instructions.
         2) Lubricating schedule including type, grade, temperature, and frequency range.
         3) Parts list, including source of supply and recommended spare parts.
         4) Name, address, and 24-hour telephone number of each subcontractor who installed equipment and systems, and local representative for each type of system.
         5) Other pertinent data applicable to the maintenance of particular systems or equipment.
      b. These recommended preventive maintenance actions shall be categorized by the following recommended frequencies:
         1) Weekly
         2) Monthly
         3) Quarterly
         4) Semi Annual
         5) Annual
         6) Other

B. Posted Operating Instructions and Diagrams:
   1. Operating Instructions:
      a. Copies of operating instructions provided in the Systems Manual shall be posted in the near vicinity of each piece of applicable equipment. The instructions shall be mounted neatly in frames under Plexiglas, where they can be easily read by operating personnel. Instructions mounted outdoors shall be suitably protected from weather.
   2. Posted Systems Diagrams:
      a. Simplified one (1) line diagrams of the systems listed shall be developed using AutoCAD and posted neatly under Plexiglas in the main or most appropriate equipment room for easy reference by operating and maintenance personnel. These drawings shall be done in a professional manner which is acceptable to the Owner. The diagrams shall show each component including all valves installed in the system, with name and identifying number. If space does not permit valve numbers on the diagrams, valve charts shall be provided. Explanatory notes, where needed, shall be provided.
         1) HVAC controls diagrams
         2) Hydronic distribution systems
         3) Air handling/ventilation systems
         4) Domestic water systems
         5) Other systems as applicable
      b. These diagrams shall be suitable for reduction in size and use in the Systems Manual system descriptions previously covered.

3.9 SYSTEMS TRAINING

A. The Mechanical Contractor, and appropriate sub-contractors, shall provide comprehensive systems instruction on building systems prior to delivery. The instruction shall include classroom instruction delivered by competent instructors based upon the contents of the Systems Manual. Emphasis shall be placed upon overall systems diagrams and descriptions, and how system components interact. The classroom instruction shall also include detailed equipment instruction by qualified manufacturer's representatives for which operating instructions are provided. The manufacturer's representative training shall emphasize operating instructions and preventive maintenance as described in the Systems Manual. At a minimum, the training sessions shall cover the following items:
   1. Types of installed systems
   2. Theory of operation
      a. Design intent
      b. Occupied vs. unoccupied or partial occupancy
      c. Seasonal modes of operation
      d. Emergency conditions and procedures
      e. Comfort conditions
      f. Indoor air quality
      g. Energy efficiency
      h. Other issues important to facility operation
   3. System operations
   4. Use of control system
      a. Sequence of operation
      b. Problem indicators
      c. Diagnostics
      d. Corrective actions
   5. Service, maintenance, diagnostics, and repair
   6. Use of reports and logs
   7. Troubleshooting, investigation of malfunctions, and determining reasons for the problem.

B. Each classroom training period shall be followed by an inspection, explanation, and demonstration of the system by the instructors. The applicable equipment shall be demonstrated including system startup and shutdown, with the exception of sprinkler systems.

C. The contractor shall be responsible for organizing, arranging, and delivering this instruction in an efficient and effective manner on a schedule agreeable to the Owner.

D. The contractor shall provide, at or before substantial completion, a proposed agenda and schedule of the above training for approval by the Commissioning Authority and the Owner.

END OF SECTION

SECTION 23 21 13 HYDRONIC PIPING SYSTEMS

PART 1 - GENERAL

1.3 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.4 DESCRIPTION OF WORK

A. The Contractor shall furnish and install the Hydronic Piping Systems for heating hot water and chilled water as shown on the drawings including specialties shown or called out in the equipment list and as necessary for satisfactory operation of the system.

1.5 RELATED WORK IN OTHER SECTIONS

22 05 23	VALVES
22 07 00	PIPING INSULATION
22 10 00	PIPE AND PIPE FITTINGS
23 00 00	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 19	PIPING SPECIALTIES
23 05 48	VIBRATION ISOLATION AND EXPANSION COMPENSATION
23 05 93	BALANCING OF MECHANICAL SYSTEMS
25 30 00	CONTROLS AND INSTRUMENTATION

PART 2 - PRODUCTS

2.5 PIPE AND PIPE FITTINGS

A. Pipe and pipefittings shall be as described in Section 22 10 00 - PIPE AND PIPE FITTINGS.

2.6 VALVES

A. Valves other than automatic control valves shall be provided as shown or required to protect the system and are specified in Section 22 05 23 - VALVES.

B. Automatic control valves are specified in Section 25 30 00 - CONTROLS AND INSTRUMENTATION.

2.7 COILS

A. Water coils are as specified on the Mechanical Equipment Schedule on the drawings.

B. Water coils shall be provided with a manual air vent located in the system piping, in addition to the one provided with the coil in order to purge any trapped air from the coil and associated piping.

2.8 PUMPS

A. Pumps shall be of the type and capacity listed in the equipment schedule and shall be furnished with open drip proof motors. Pumps shall be selected so that the motors will not overload under any possible operating condition including open discharge. Furnish one spare mechanical seal for each pump. All pumps shall have drain pans with tapped pipe connections and 3/4-inch drain line extended to floor drain. Pumps shall be installed so that they may be removed without the removal of the associated piping. All pump strainers shall be provided with blow off valves and lines full size extended to floor drain.

2.9 EXPANSION TANKS

A. Expansion tanks shall be as scheduled on the drawings. Expansion tanks in antifreeze-protected systems shall be constructed and labeled for service in antifreeze-protected systems.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping installation shall conform to the requirements of Section 22 10 00 - PIPE AND PIPE FITTINGS.

B. Installation of specialties shall conform to the requirements of Section 23 05 19 - PIPING SPECIALTIES.

3.2 TESTS

A. All piping shall be proved tight at a hydrostatic pressure of 150 psi and show no loss in pressure for a period of one hour.

END OF SECTION

SECTION 23 25 00 WATER TREATMENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. The Contractor shall provide all labor, material, equipment, design detail and layout required to provide complete water treatment systems indicated in these specifications. The Contractor shall coordinate installation of the water treatment system(s) with the trades involved in constructing other systems. The contractor shall furnish all piping, valves, equipment, meters, probes, tanks, pumps, controls, wiring, etc., for the water treatment system. The water treatment contractor shall coordinate location of required electrical receptacles with electrical contractor and piping instrument taps or wells with the piping contractor and obtain final approval from Architect/Engineer, with any additional cost incurred by this contractor. The Contractor shall not hold the Owner liable for any lack of coordination.

1.3 RELATED WORK IN OTHER SECTIONS

22 07 00	PIPING INSULATION
22 10 00	PIPE AND PIPE FITTINGS
23 01 00	DEMONSTRATION AND TRAINING
23 00 00	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

1.4 GENERAL

A. All systems and components shall be furnished and installed by one Contractor. The contractor shall have a minimum of five (5) years experience in design and installation of water treatment systems. The Architect/Engineer may reject any proposed installer who cannot show evidence of such qualifications.

B. The system components and information herein is intended to establish standards of performance, quality and construction.

1.5 SUBMITTALS

A. In addition to submittals required under GENERAL PROVISIONS the contractor shall furnish a 1/8" scale (minimum) room floor plan indicating location and connection points of all equipment to be installed.

PART 2 - PRODUCTS

2.1 WATER TREATMENT - SYSTEM(S)

A. Hot Water Boiler:
   1. Provide a boiler water treatment system for the hot water boiler(s) to inject controlled amounts of non-chromate chemicals into the boiler(s) as required to prevent scaling and corrosion of the closed loop system.
   2. The Contractor shall provide all necessary chemicals and service for one year. The Contractor shall provide the Owner with written reports, analysis, and recommendations on a monthly basis during the year with weekly reports when the boiler is in operation.
   3. The equipment shall consist of a by-pass feeder similar to Neptune Chemical Pump Company VTF, or approved equal. The quantity of the chemical shall be determined by a qualified water treatment chemist for each type of installation.
   4. Provide a ball or gate valve and a check valve at each connection. Connecting tube may be plastic or copper as preferred by the Contractor and approved by Code for the location where installed.
   5. The chemical shall be formulated by a water treatment chemist to prevent scale formation in the boiler and any foaming in the boiler. An oxygen scavenger shall be included.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the system(s) completely. After the equipment and piping system have been installed and cleaned thoroughly and are ready to be filled, the treatment contractor shall provide the necessary treatment, for the fill of all piping and related equipment. The contractor shall be present at initial fill of the system(s).

B. After operation of several hours, the treatment level in all systems shall be checked and adjusted to the proper level.

C. After operation for several days, the treatment level of all systems shall be checked and adjusted. Repeat in 30 days.

D. The installer shall be responsible for adjusting the proper amounts of chemicals on a monthly basis for the first year.

E. Instruct the owner in proper methods of testing and adjusting the water treatment equipment and chemicals.

END OF SECTION

SECTION 23 30 00 AIR DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install fans, filters, sheet metal work, grilles, louvers, diffusers, registers, sound traps, special fan bases, fire dampers, combination fire and smoke dampers and sleeves, accessories and natural gas fired appliance flue vents.

B. All automatically controlled dampers furnished under Section 25 30 00 - CONTROLS AND INSTRUMENTATION will be installed under this section. After dampers are set, they shall be balanced for free and easy operation.

C. Where ductwork has an interior lining, dimensions shown on drawings shall be clear dimensions inside the liner.

D. Prior to system test and balance, supply and install new, clean air filters throughout the air handling systems except for any high efficiency filters, which have pressure drop within normal operating limits.

1.3 REQUIREMENTS AND RELATED WORK

23 00 00	HEATING, VENTILATING, AND AIR CONDITIONING INDEX
23 05 00	GENERAL HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 93	BALANCING OF MECHANICAL SYSTEMS
23 07 13	DUCT INSULATION
25 30 00	CONTROLS AND INSTRUMENTATION

1.4 REFERENCES

A. ASTM A36 - Structural Steel

B. ASTM A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles

C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

D. ASTM A366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality

E. ASTM A480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

F. ASTM A525 - General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process

G. ASTM A527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality

H. ASTM A568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled

I. ASTM A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality

J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate

K. AWS D9.1 - Welding of Sheet Metal

L. NFPA 90A - Installation of Air Conditioning and Ventilating Systems - Latest Edition

M. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems -Latest Edition.

N. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying - Latest Edition

O. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment - Latest Edition

P. SMACNA - HVAC Air Duct Leakage Test Manual

Q. SMACNA - HVAC Duct Construction Standards - Metal and Flexible - 1985

R. UL STANDARD 181 - Factory-Made Air Ducts and Connectors

S. UL STANDARD 555 – Standard for Safety Fire Dampers

T. UL STANDARD 555S – Leakage Rated Dampers for use in Smoke Control Systems

U. UL STANDARD 1738 – Standard for Venting Systems for Gas Burning Appliances, Categories II, III, and IV

PART 2 - PRODUCTS

2.1 EQUIPMENT SCHEDULES

A. All major items of equipment are specified in the equipment schedule on the drawings and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory operating system.

B. All registers, grilles and diffusers shall be as listed in the schedule on the drawings. Frame style shall be coordinated by the Contractor to match the ceiling type shown on the reflected ceiling plans of the Contract Documents.

2.2 DUCTWORK

A. Sheet Metal
1. Materials and Gauges: Construct all ducts, casings, plenums, etc., of galvanized steel sheets, of the gauges specified below, unless otherwise shown. Sheets shall be free from blisters, slivers, pits and imperfectly galvanized spots.
2. All ductwork shall be constructed in accordance with "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE". First Edition, 1985 as published by Sheet Metal and Air Conditioning Contractors National Association, Inc. Pressure class for all ductwork shall be 2” or unless otherwise noted on plans.
3. Construct low velocity ducts using Pittsburgh or "Snap-Lock" corner seams. All seams shall be made airtight. Using United Mc Grill “UNI-FLEX” duct sealer or approved equal.
4. Connections of high pressure and/or velocity ducts, fittings and high-pressure boxes shall be made airtight by tack welding on 8" centers and coating joints with United Mc Grill “United duct Sealer”.
5. Round ducts and fittings for high velocity systems shall be spiral lock seam conduit as manufactured by United Mc Grill Co., Inc., or approved equal. All 90 elbows shall be at least 5-piece construction. Standard manufactured ducts of other than spiral construction will be acceptable if constructed of the following gauges with welded seams. Sizes thru 12-inch diameter shall be 22-gauge, 13 inch thru 36-inch diameter shall be 20 gauge, 37 inches and over shall be 18 gauge. Basic high velocity fittings are detailed on the drawings. Spun or tapered takeoffs shall be used from all vertical high velocity risers.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 time’s width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible, maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45-degree lateral wye takeoffs unless otherwise indicated where 90-degree conical tee connections may be used.

F. Flexible
   1. Flexible ducts for connections between rigid ductwork and variable volume boxes shall be Factory Insulated flexible conduit capable of holding 5 inches W.C. without development leaks and shall not exceed a flame spread of 25 or a smoke development of 50. Thermo flex Type N-KH or approved equal.
   2. Flexible connections between the diffusers and the run out ducts shall be factory insulated, sound absorbing low velocity flexible conduit conforming to the following duct fabrication shall not exceed a flame spread of 25 or a smoke development of 50.
      a. Two ply vinyl film supported by helically wound spring steel wire: fiberglass insulation: polyethylene vapor barrier film.
      b. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
      c. Maximum Velocity: 4000 fpm (20.3 m/sec).
      d. Temperature Range: -10 degrees F to 160 degrees F (-23 degrees C to 71 degrees C).

2.3 COMBINATION FIRE/SMOKE DAMPERS

A. Furnish and install at locations shown on plans, or as required by code combination fire/smoke dampers meeting the following specifications. Frame shall be galvanized steel formed into a structural hat channel shape with tabbed corners for reinforcement.

B. Each combination fire smoke damper shall be 1-1/2-hour fire rated under UL Standard 555 or greater where noted on architectural plans, and bear a UL label attesting to same. Damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. The leakage rating under UL555S shall be Leakage Class II (10 cfm/ft. at 1” w.g.)

C. In addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 250º F, 350ºF, or 450ºF depending upon the actuator. Appropriate electric “Firestat” operator shall be installed by the damper manufacturer at time of damper fabrication. Damper and actuator shall be supplied as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators. Manufacturer shall provide factory assembled sleeve of 16” minimum length (contractor to verify requirement). Factory supplied caulked sleeve shall be 16 gauge for dampers up to 36” wide by 24” tall and 14 gauge above 36” wide X 24” tall.
   1. Combination Fire/Smoke dampers shall be Ruskin FSD6O rectangular dampers and Ruskin FSDR25 for round dampers or approved equal with correct mounting frames and sleeves for actual installation.
   2. Combination Fire/Smoke dampers for corridors ceiling shall be Ruskin FSD36 with internally mounted actuator.

D. Each combination fire and smoke damper shall include an integral factory furnished and installed duct smoke detector compatible with the building fire alarm system. Assembly by Ruskin DSDN or approved equal.

E. Size of access doors in ductwork shall be 2 inches less than the width of the duct by 12 inches, up to a maximum size of 24 inches by 24 inches.

2.4 FIRE DAMPERS

A. Furnish and install at locations shown on the drawings or as required by code fire dampers meeting the following requirements. Provide access doors at all fire damper locations of sufficient size to allow easy resetting of fire damper linkage. Fire damper links shall be of the test strength recommended to prevent nuisance closing. All fire dampers shall conform to the requirements of NFPA Pamphlet 90A and shall meet the required UL Standard 555.

B. High Velocity Round or Oval Fire Dampers: High velocity fire dampers shall be of the folding blade type designed for minimum static pressure drop. Fusible links shall be accessible from either side of the damper. Each damper shall be furnished complete with a galvanized welded steel sleeve (round or oval) and closure compartment to house the folded blades. Fire dampers shall be Ruskin FD35 with 165°F fusible link or approved equal.

C. Rectangular Fire Dampers: Fire dampers for rectangular ductwork shall be of the folding blade type with the hinged blades completely out of the air stream of the single hinged blade type. Fusible links shall be accessible from either side of the damper. Each damper shall have a galvanized welded steel sleeve (rectangular or square) and closure compartment to house the folded blades. Rectangular fire dampers

mounted in the horizontal plane are to be spring loaded. Fire dampers shall be Ruskin DIBD with 165°F fusible link or approved equal.

D. Provide access doors at all fire damper locations of sufficient size to allow easy resetting of fire damper linkage. Size of access doors in ductwork shall be 2 inches less than the width of the duct by 12 inches, up to a maximum size of 24 inches by 24 inches.

E. Each fire damper shall be provided with spare fusible link(s) secured to the damper.

2.5 ACCESS DOORS

A. Wall and Ceiling Access Doors: Furnish as required in Section 230500, paragraph 3.6.

B. Duct Access Doors: Duct access doors at fire dampers and other locations which require access to mechanical devices inside of ductwork shall be Controlair 16-gauge access door with continuous hinge, neoprene gasket, thumb screw locks and baked enamel finish. Doors shall be sized for easy access to mechanical device.

C. Doorframes on insulated ductwork shall be placed on an extended metal collar flush with the face of the finished insulation.

D. Latches shall be operable from either side of door and shall be "Ventlok" No. 310.

2.6 FILTERS

A. Filters shall be as listed in the schedule on the drawings.

B. Filter gauge for each bank of filters in the mechanical rooms and roof top equipment will be supplied and installed by the Controls Contractor as specified in Section 253000 - CONTROLS AND INSTRUMENTATION.

2.7 COILS

A. In no case shall specified air or water pressure drops be exceeded more than 10%. Piping connections shall be as shown on the drawings. Coils shall be as specified in the equipment schedule on the drawings. In no case shall rows or fin spacing be less than the minimum surface scheduled.

2.8 TURNING VANES

A. Turning vanes shall be installed in all square elbows. Turning Vanes shall be air foil blade type, shop or factory fabricated.

2.9 FLUE GAS VENTS

A. Gas fired equipment shall be vented in accordance with the Uniform Mechanical Code, Uniform Plumbing Code and local codes and ordinances.
   1. Natural draft appliances shall have Type “B” vents.
   2. Forced draft appliances shall have Metalbestos Type PS, 16-gauge black steel vents.
   3. Condensing boilers shall be double wall stainless steel, constructed in modular sections by Jeremias DWGV or approved equal, and shall be UL listed under UL 1738, approved type 444, 316L, or AL29-4C for interior liner, and type 304 stainless steel outer jacket.

PART 3 - EXECUTION

3.1 INSTALLATION OF SHEET METAL WORK

A. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary the required area shall be maintained. All of these changes, however, must be approved and installed as directed at the project. During the installation, the open ends of ducts shall be protected to prevent debris and dirt from entering. Whenever exposed ducts pass through walls, floors or ceilings, a flanged sheet metal collar fitting close around ducts shall be slipped along duct until flange is tight against

finished surface covering edges of openings and presenting a neat appearance. Collar shall be locked to duct.

B. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

C. Use double nuts and lock washers on threaded rod supports.

D. Connect diffusers or light troffer boots to low-pressure ducts with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

E. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

F. All ducts, coils, housings, registers, grilles, fans, etc., shall be clean when installed and shall be kept clean until the system is completed. As the various parts of the system are installed, they shall be wiped or blown clean and openings taped dust-tight with heavy paper or cardboard until the system is completed and ready for testing. At that time all covers and protective wrappings shall be removed. Where one has been torn or previously removed, the duct, coil, register, etc., shall be carefully cleaned of any dirt or dust that has entered the opening.

3.2 DUCTS AT MASONRY

A. Where ducts are shown connecting to masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2" x 1/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal in these locations shall be bolted to the angle iron.

3.3 HAND AND SPLITTER DAMPERS

A. Install hand operated volume and splitter dampers at all locations of branches of main ducts, from equipment, supply ducts, return ducts and at all locations where air flow splits or is balanced, whether shown or not. Volume dampers shall be controlled by heavy duty locking quadrants mounted on the outside of the duct. Where ducts are insulated the damper rod shall be extended and the operator shall be mounted on the outside of the insulation. Where volume dampers are installed in ducts over 12" deep, the dampers shall be made in two sections and each independently operated. Splitter dampers shall be at least 1 1/2 times as long as the narrowest adjacent split. All damper fittings must be heavy commercial items and must be approved by the Architect/Engineer before installation.

3.4 FLEXIBLE CONNECTIONS

A. Provide glass fabric, neoprene coated flexible connections, not less than 6" wide at the inlet and outlet connection of each fan unit, securely fastened to the unit and to the ductwork. Material shall comply with Underwriter's Laboratories Standard 214.

B. Indoor applications shall have Metaledge Ventglas with heavy glass fabric, double coated with Dupont's Neoprene.

C. Outdoor applications shall have Metaledge Ventlon with heavy glass fabric, double coated with Dupont's Hypalon.

3.5 CROSS BREAKING

A. Rectangular sheet metal ducts shall be cross-broken on the four sides of each 4-foot panel. All vertical and horizontal sheet metal barriers, duct offsets, elbows, as well as 4-foot panels of straight sections of ducts shall be cross-broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles. The center of the cross break shall be of the required height to assure surfaces being rigid. High velocity plenum panels and ductwork shall not be cross-broken.

3.6 TEST HOLES IN DUCTWORK

A. Furnish test holes in ducts at locations required by the testing and balancing team for testing of air quantities in ducts. Ventlok No. 699, closures shall be provided and installed for each test hole, with sufficient neck length to penetrate the insulation.

3.7 HANGERS AND SUPPORTS

A. Hangers for ducts up to 18 inches in width or diameter shall be placed not more than ten-foot centers. Ducts 19 inches and over in width or diameter shall be supported on not more than five foot centers. Hangers shall be placed plumb and present for a neat appearance. Construct hangers for high velocity boxes and for ductwork form galvanized iron 1" x 1" x 1/16" for ducts up to 36 inches in width or diameter. For ducts over 36 inches in width or diameter, support ducts every 4'-0" with 1 1/4" x 1 1/2" x 1/8" angles. The use of perforated band iron for duct support is prohibited. Hangers shall extend down the sides of the ducts using not less than three rivets or parker screws of appropriate sizes. It is essential that all ducts be rigidly supported. Where vertical ducts pass thru floors or roofs heavy supporting angles shall be attached to ducts and to the structure. Angles shall be of sufficient size to support ductwork rigidly. Place supporting angles on at least two sides of the duct.

3.8 FABRICATION

A. All ductwork shall be fabricated with the mill markings on the outside.

3.9 TESTS

A. Testing and balancing of the air tempering systems will be as specified in Section 230593 - BALANCING OF MECHANICAL SYSTEMS.

B. If specified conditions cannot be obtained due to deficiencies in equipment performance or improper installation or workmanship, the Mechanical Contractor shall make any changes necessary to provide the specified conditions.

C. Cleaning ducts and testing for tightness: Before the ceiling is installed and final connections are made to air outlet devices, operate the fans at full capacity to blow out dirt and debris from the ducts. If it is not practical to use the main supply blower for cleaning, the ducts may be blown out in sections by a portable fan. After the ducts have been cleaned, an air tightness test shall be made on all ductwork. A minimum pressure equal to fan static pressure at less than 10% of design flow or 2 1/2 times design external static pressure, whichever is less shall be maintained during the test. A soap test shall be applied to all sheet metal connections and joints to locate air leaks. Air leaks which are in excess of that required to bubble the soap suds (that is, actually blow the suds away), shall be sealed by additional taping and caulking to reduce the leakage to a rate not to exceed slow bubbles forming. In lieu of the above tightness tests, the Contractor may test the ducts by attaching a fan with a capacity of not over 300 cfm at 2 1/2" static pressure to the ductwork and with outlets blocked airtight, build up the pressure in the ducts to 2" water gauge. If this pressure cannot be obtained the Contractor shall locate and repair the leaks as specified above. The Architect/Engineer and Owner's Representative shall witness the test and the Contractor shall notify the Insulation Contractor in writing when the test has been satisfactorily completed.

END OF SECTION

SECTION 25 00 00 INTEGRATED AUTOMATION INDEX

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Integrated Automation Work, as indicated on the Drawings and specified herein. Integrated Automation work indicated on the Drawings and/or specifications covering other trades shall conform to Division 25 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Integrated Automation systems shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for Integrated Automation service connections to all the various items of equipment requiring controls service throughout the project shown on the Contract Drawings (even if not shown on Integrated Automation Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 INTEGRATED AUTOMATION DIVISION INDEX

25 05 00	GENERAL INTEGRATED AUTOMATION REQUIREMENTS
25 09 00	MECHANICAL SYSTEM INSTRUMENTATION AND CONTROL
25 11 00	ELECTRICAL CONTROLS AND INTERLOCKS
25 30 00	CONTROLS AND INSTRUMENTATION
25 60 00	MECHANICAL AND ELECTRICAL COORDINATION SCHEDULE

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 25 05 00 GENERAL INTEGRATED AUTOMATION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General Mechanical Requirements specifically applicable to Division 25 sections in addition to Division 1 - General Requirements.

B. Scope:
   1. The work covered by this division consists of performing all operations in connection with the installation of heating, cooling, ventilating, and plumbing including site utility work as indicated under this section. This entire section applies to all mechanical work and all mechanical sections of these specifications. This Contractor shall read and comply with all sections of these specifications including all General and Special Conditions.

1.2 REFERENCES

A. Standard Requirements:
   1. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. All work shall be executed in accordance with the local and state codes, ordinances, and regulations governing the particular class of work involved. This Contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Where these specifications and accompanying drawings conflict with these requirements, the Contractor shall report the matter to the Architect/Engineer. The Architect/Engineer shall prepare any supplementary drawings required, illustrating how the work may be installed so as to comply. On approval of the change by the Architect/Engineer, the Contractor shall install the work in a satisfactory manner without additional cost to the Owner. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved, and on completion of the work, this Contractor shall obtain and deliver to the Owner final certificates of acceptance. This Contractor shall furnish copies of each certificate to the Architect/Engineer.

C. The Contractor shall secure all permits and licenses for their work and shall pay all fees in connection with such permits and licenses.

D. The contractor shall hold and save the Owner free and harmless from liability of any nature or kind arising from their failure to comply with codes and ordinances.

E. Any and all meter deposits and all utility extension costs shall be paid by the Contractor whose work is done in connection with the service that the meter is connected to.

F. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:

1.	AABC	Associated Air Balance Council
2.	ADC	Air Diffusion Council 435 North Michigan Ave. Chicago, IL 60611
3.	AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
4.	ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
5.	ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers 345 East 47th Street New York, NY 10017
6.	ASME	American Society of Mechanical Engineers 345 East 45th Street New York, NY 10017
7.	ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103

8.	FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
9.	FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Building 197 Washington, DC 20407
10.	NBFU	National Board of Fire Underwriters 5530 Wisconsin Avenue, Suite 750 Chevy Chase, MD 20815
11.	NEC	National Electric Code (of NFPA)
12.	NEBB	National Environmental Balancing Bureau 8224 Old Courthouse Road Vienna, VA 22180
13.	NEMA	National Electrical Manufacturer's Association 2101 L Street, NW Washington, DC 20037
14.	NSF	National Sanitation Foundation Box 1468 Ann Arbor, MI 48106
15.	OSHA	Occupational Safety and Health Administration U.S. Department of Labor
16.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association 8224 Old Courthouse Road Vienna, VA 22180
17.	TIMA	Thermal Insulation Manufacturers Association Technical Services 1420 King Street Alexandria, VA 22314
18.	UL	Underwriters Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

G. Underwriters Laboratories Inc. (UL): All materials, appliances, equipment, devices, or appurtenances shall conform to the applicable standards of Underwriters Laboratories Inc., where such standards have been established.

1.3 DRAWINGS

A. Drawings and specifications shall be considered as cooperative, and work or materials called for by one and not mentioned in the other, or vice versa, shall be done and furnished as though treated by both.

B. In the cases of discrepancies in figures, drawings, or specifications, the Architect/Engineer shall be notified immediately, and their decision shall determine the necessary adjustment. Without such decision, said discrepancies shall not be adjusted by the Contractor save only at their expense, and, in case of any settlement or any complication arising from such adjustment to the Contractor, they shall bear all extra expense involved.

C. Should it appear that the work intended to be done, or any of the matters relative thereto, are not sufficiently detailed or explained on the drawings or specifications, the Contractor shall apply to the Architect/Engineer for such further drawings or explanations as may be necessary, allowing a reasonable time for the Architect/Engineer to supply same, and the Contractor shall conform to same as part of the Contract.

D. Should any doubt or question arise in respect to the true meaning of the drawings or specifications, reference shall be made to the Architect\Engineer whose decision shall be final and conclusive. No alleged oral admission, condonation, or inadvertent neglect on the part of the Architect/Engineer will be accepted as an excuse for inferior work.

E. The mechanical plans do not give exact details as to elevations of ductwork and piping, exact locations, etc., and do not show all offsets, control lines, pilot lines, and other installation details. The Contractor shall carefully lay out their work at the site to conform to the structural conditions, provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated, satisfactory operational installation.

F. Should the particular equipment which any Bidder proposes to install, require other space conditions than those indicated on the drawings, the Bidder shall arrange for such space with the Architect/Engineer before submitting their bid. Should changes become necessary on account of failure to comply with these details, the Contractor shall make such necessary changes at their (the Contractor's) own expense.

G. The Contractor shall submit working scale drawings of all their apparatus and equipment which in any way varies from these specifications and plans which shall be checked by the Architect/Engineer and approved before the work is started, Contractor before work proceeds. Interference with structural conditions shall be corrected by the Contractor.

H. All equipment shall be installed in accordance with the manufacturer's recommendations. Provide all accessories and components for optimum operation as recommended by the manufacturer.

1.4 SYSTEM DESCRIPTIONS

A. Not Used.

1.5 PRIOR APPROVALS

A. Each equipment item for which the Contractor desires to install equipment other than the specific item identified in the equipment schedule or equivalent equipment by manufacturers specifically named in the schedule, the Contractor shall bear full responsibility to prove to the Engineer that the furnished equipment is equivalent to or better than the specified item. Failure to provide such proof will result in rejection of the shop drawing submittal by the Engineer. Prior written or verbal approval by the Engineer of equipment by other manufacturers will not relieve the Contractor of responsibility to provide equivalence. Prior approval is required, however, any prior approval given is intended only to provide preliminary agreement that the alternate manufacturer may make equipment that complies with the specification requirements and not that all equipment manufactured by them is acceptable.

1.6 SHOP DRAWINGS

A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this Contract. This shall include piping, ductwork, mechanical equipment, plumbing equipment, control items, etc. The Contractor shall submit to the Architect/Engineer a sufficient number of copies of all such shop drawings or catalog data to provide them with as many review copies as they may need, plus three (3) copies for retention by the Architect/Engineer. No materials or equipment shall be installed until officially approved by the Architect/Engineer.

B. Before submitting Shop Drawings to the Architect/Engineer for review, the Contractor shall examine them and satisfy themself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of Shop Drawings is not intended to take the place in any way of the official review of the Architect/Engineer, and the Shop Drawings which have not been reviewed by the Architect/Engineer shall not be used in fabrication or installing any work.

C. The review of Shop Drawings or catalog data by the Architect/Engineer shall not relieve the Contractor from responsibility for deviations from the plans and Specifications unless they have, in writing, specifically called attention to such deviations as the time of submission and has obtained the permission of the Architect/Engineer thereon, nor shall it relieve them from the responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect/Engineer, they shall state in their letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

D. After receiving approval on the make and type of materials, the Contractor shall order such materials in sufficient time so that no delay or changes will be caused. This is done to facilitate progress on the job and failure on the part of the Contractor shall render them liable to stand the expense of any and all delays occasioned by failure on this part to provide necessary details. All shop drawings shall be delivered to the Architect/Engineer's office within thirty (30) days from the date of the contract.

E. Shop drawings will be returned unchecked unless the following information is included: reference to all pertinent data in the Specifications or on the drawings, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.

1.7 SUBMITTALS

A. Submittal data shall be organized in commercial quality, three ring binders with durable and cleanable covers. Product information for each piece of equipment shall be separated by an indexing leaf with clear tabs. The product name and symbol (i.e., AHU/Air Handling Unit) shall be typed on white paper inserts and placed in appropriate tab. Complete data must be furnished showing performance, quality, and dimensions. A signed review by the Architect/Engineer must be obtained before purchasing any equipment.

B. The following items shall be submitted for review by the Architect/Engineer but are not limited to:
   1. Temperature Controls
   2. Vibration Equipment and Calculations

1.8 QUALITY ASSURANCE

A. General: Comply with Division 1.

B. Welder Qualifications: Welders shall be certified by the American Society of Mechanical Engineers (ASME) National Certified Pipe for the type of work being performed. Current operators' certificates in accordance with ASME standards shall be on file at the site and shall be available to the Architect/Engineer for examination. Coupons shall be available for review by the Architect and Engineer.

C. Locations of all pipes, ducts, outlets, appliance, etc., as shown on the drawings, are approximate only and are understood to be subject to such revisions as may prove necessary or desirable at the time the work is installed. Each Contractor will be required to install their work with relation to existing building conditions and shall be entirely responsible for the correctness of their work with reference to finished elevations, etc. Piping shown on the drawings is diagrammatic only and their exact locations, depths, and invert elevations shall be as required for proper flow and coordination with other trades.

D. The contract drawing depicts graphically the arrangement of piping and ductwork. Should local conditions necessitate a rearrangement, or if any of the piping or ductwork can be installed to better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit three (3) copies of Drawings of the proposed arrangement for the Architect/Engineer's review.

E. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, they shall assume full responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such change shall be accompanied by Shop Drawings of the space in question.

F. Each Contractor is responsible for the proper location and size of all slots, holes, or openings in the building structure pertaining to their work, and for the correct location of pipe sleeves.

G. Each Contractor shall coordinate their work with that of all other trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines which require a stated grade for proper operation. Drainage lines shall take precedence over water lines in determination of elevations. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

H. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Lubricate all equipment properly in accordance with manufacturer's instructions. Furnish zerk grease fittings on all greaseable bearings.

I. Equipment and Materials: The materials and equipment shall be new and shall be the standard products of the manufacturers regularly engaged in the production of Plumbing, Heating, Cooling, Ventilation, and Fire Protection Equipment, and shall be the manufacturer's latest standard design. Where two or more units of the same class of equipment are required, these units shall be the products of the same manufacturer. However, the component parts of the systems need not be the products of the same manufacturer. Specific equipment specified hereinafter is to be considered a standard of quality and operation. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the drawings. Reference shall be made to the schedules for specific information. The capacities shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Architect/Engineer. All equipment shall be shipped to the job with not less than a prime coat of paint or as specified hereinafter. Insofar as is possible all items of the same type (i.e., pumps, fans, etc.) shall be by the same manufacturer. Where installation instructions are not included in these specifications or on the plans, the manufacturer's instructions shall be followed. All equipment affected by altitude shall be rated to operate at the altitude where it is to be installed.

J. Excavation and Backfilling: This Contractor shall do all necessary excavation and backfill for the installation of the Mechanical systems as may be required. Curb cuts, asphalt, and concrete patching, cutting, and patching existing floor, etc., shall be part of this Contractor's responsibility. No extra payment will be made for rock excavation. Trenches for all underground piping shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to ensure the pipe resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe, and before laying the pipe, the space between the bottom of the pipe and the rock surface shall be filled with gravel, thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down in the trenches and shall be filled. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. The backfill material shall be identical to the surrounding fill material and shall be placed in a 6-inch layer, wetted, and compacted to the density of the adjacent soil. See Division 2 for additional information for site utilities. All surplus materials shall be hauled from the project by the Contractor at their expense.

K. Cutting and Repairing:
1. Responsibility of the Contractor whose work is involved. Coordinate with others to prevent unnecessary cutting and repairing.
2. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports. Arrange with those whose work is involved to do cutting and replacing caused by negligence or error with costs reimbursed by the Contractor at fault. Cutting and replacing of existing work shall be the responsibility of the Contractor whose work is being installed.
3. Removal or terminating connections of existing work which is abandoned or replaced shall also be done hereunder to provide correct and finished work.

L. Foundations: All equipment shall be provided with suitable foundations and supports. It shall be the responsibility of the Contractor to provide for the proper locations of these foundations and supports. This applies to all rooftop equipment also.
1. All concrete foundations required by equipment furnished by the Mechanical Contractor shall be constructed by them (except where otherwise noted) the conformity with the recommendations of the manufacturer of the respective equipment, and with the approval of the Architect/Engineer. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow 1 inch below the equipment base for alignment, leveling and grouting with nonshrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed.
2. Unless otherwise noted, foundations shall be a minimum of 6 inches high. All concrete work performed by these Contractors shall conform entirely to the requirements of the Concrete Specifications which describe this class of work.

M. Code Requirements: Comply with state and local code requirements and ordinances. Call for inspections required by responsible building inspection authority.

N. Applicable Building Codes and Ordinances: Including the latest edition of each code, but not limited to the following:
1. International Building Code.
2. Uniform Mechanical Code.
3. Uniform Plumbing Code.
4. Governing Fire Department Requirements
5. Utility Company Requirements
6. National Fire Protection Association Standards
7. NFPA 70 - National Electrical Code
8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems
9. NEPA 90B - Installation of Warm Air Heating and Air Conditioning Systems
10. NFPA 13 - Sprinkler Systems
11. NFPA 101 - Life Safety
12. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment

O. Access Panels
1. Similar to Milcor, or as noted on the drawings, size as required for concealed expansion joints, valving, gauges, balancing dampers, valves, traps, pitot stations, equipment and similar items requiring accessibility. Notify the General Contractor of each access panel location and the required size. Panels shall be proper type for ceiling or wall in which they are installed. The panels shall be furnished under this section of the Specifications, unless otherwise directed, but shall be coordinated to be compatible with walls and ceilings furnished under other sections.

1.9 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1.

B. Large Items: Make arrangements with other trades on the job for introduction into the building of equipment too large to pass through finished openings.

C. Acceptance: Check and sign for materials to be furnished by others for installation under all Mechanical Divisions upon delivery. Contractor shall be responsible for the storage and safekeeping of such materials from time of delivery until final acceptance.

D. Protection: Close ends of pipe and ductwork at the close of each working day during construction to prevent entry of foreign material. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work with heavy paper or plastic until final clean-up.

E. Storage: Store equipment in covered enclosure or wrap with weather tight 6 mil Visqueen.

F. Shipping Protection: Protective casings, crating, and coverings to remain in place until start-up of equipment.

1.10 PROJECT CONDITIONS

A. Performance: All systems are to be rated at 4,000 ft. elevation.

1.11 SEQUENCING AND SCHEDULING

A. General: Comply with Division 1.

B. Schedule: Coordinate and order the progress of mechanical work to conform to the progress of the work of the other trades. Complete the entire installation as soon as the condition of the building will permit.

C. Utility Interruptions: Schedule mechanical utility interruptions with the Architect/Engineer/Owner minimum of seven (7) days prior to the requested outage. Plan work so that duration of the interruptions a maximum of one day.

1.12 CONTROLS WIRING AND ELECTRICAL EQUIPMENT

A. All mechanical equipment controls wiring, conduit, relays, interlocks, and all accessories required for a completely operational controls system shall be the complete responsibility of the mechanical contractor. The mechanical contractor has the option to hire the project electrical contractor or any qualified controls contractor to install mechanical controls wiring and conduit. Refer to specification 251000 for installation requirements. Refer to Specification Section 253000 for coordination requirements between mechanical, electrical, and controls subcontractors.

B. Electrical items such as disconnect switches and motor starters associated with equipment provided by Division 25, when specifically mentioned to be furnished by the Mechanical Contractor, whether in these specifications or on the Electrical or Mechanical Drawings, shall be furnished by the Contractor. These items shall be mounted and connected as required for a completely operational system. See Control Systems Specification for further information.

C. All electrical equipment characteristics (voltage, etc.) must be verified by the Contractor prior to ordering. If the Contractor proposes to furnish motors varying in horsepower and/or characteristics from those specified, they shall first inform the Architect/Engineer of the change and shall then coordinate the change with the Electrical Contractor and shall pay all additional charges in connection with the change.

1.13 PROTECTION AGAINST HAZARDOUS CONDITIONS

A. The Contractor shall take precautions against hazardous construction conditions at all times during construction. The final condition of the facilities shall be safe, and where safety to operating personnel is jeopardized, suitable signage shall be posted.

B. Protruding metal (bolts, steel angles, etc.) potentially hazardous to maintenance and operating personnel, shall be cut back and/or protected to reduce the risk of injury. All openings between floors shall be protected with barriers around the openings, gratings across the openings, or steel bars through the openings to avoid and protect against injury.

1.14 HAZARDOUS SIGNS

A. Equipment room contains moving or rotating parts, floor openings, or other potentially hazardous environments and shall include a sign on the door entering it that shall read similar to the following: **Hazardous Area - Authorized Personnel Only.**

1.15 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Mechanical Contractor shall furnish to the Owner a bound manual in triplicate, containing complete repair parts lists, and operating, service, and maintenance instructions on all mechanical equipment, fixtures, and systems.

B. The Mechanical Contractor shall also provide training as required by Section 230100 to the Owner's operation and maintenance personnel.

1.16 OPERATION PRIOR TO ACCEPTANCE

A. The Owner shall have the right to operate any and all apparatus as soon as and as long as it is in operating condition, after Owner personnel have received operational training, whether or not such apparatus has been accepted as complete and satisfactory, except that this shall not be construed to mean operations before any required alterations or repairs have been made. This operation does not indicate acceptance of the equipment by the Owner. When the Contractor enters into a contract with the Owner, they agree to the above.

1.17 WARRANTY AND SERVICE PROGRAM

A. Due to the critical performance requirements and to clearly establish warranty responsibility for this project, the Contractor shall provide a full-service maintenance and warranty program to the Owner for one full year after beneficial occupancy (substantial completion).

B. This service program shall be included as part of the base bid and shall include service, maintenance, repair, replacement, lubrication, temperature control calibration and repairs, and documenting proof for all service and maintenance work on all equipment and system furnished by the Contractor.

C. A single representative in the employment of the Contractor shall be responsible for coordination and follow through of this program. This representative's name and phone number shall be submitted to the Owner as part of the maintenance manuals and supportive data. The Contractor shall respond to a request for service with 24 hours if so requested.

D. During this first year of operation, the following sequence of maintenance service shall be performed as a minimum.
   1. Clean strainers in piping.
   2. Fans and/or pumps be lubricated and oiled once every four (4) months.
   3. Controls shall be calibrated throughout the facility at the end of six (6) months (following substantial completion). Any leaks in the piping systems shall be repaired.
   4. All equipment manufacturer's service recommendations shall be followed during this period.

1.18 FLUSHING AND DRAINING

A. It shall be the responsibility of this Contractor to properly drain and flush all ducts and pipes before use or acceptance to ensure that all debris is completely removed. Damage caused by such debris remaining in the ducts or pipes shall be repaired by this Contractor at their expense. This Contractor shall demonstrate to the Architect/Engineer's representative that all piping is clean.

1.19 CLEANING

A. This Contractor shall remove from the building construction site all rubbish and dirt as it accumulates under the contract. At completion, all areas shall be broom cleaned and all obstructions, surplus materials, etc., removed.

1.20 GUARANTEE

A. The Contractor shall guarantee all materials, equipment, and workmanship furnished and installed by them under this Contract, to be free from all defects of workmanship and materials, and shall agree to replace at their expense, without expense to the Owner, at any time within one year after installation is accepted by the

Architect/Engineer, any and all defective equipment, parts, etc., that may be found. (This excludes normal maintenance and daily servicing of equipment which is the Owner's responsibility.)

1.21 FLOOR, WALL, AND CEILING PLATES

A. Where exposed pipes pass through floors, finished walls, or finished ceiling, they shall be fitted with chromium-plated escutcheons of an approved pattern. Escutcheons and plates in Mechanical Rooms do not require chrome finish.

B. This Contractor shall be responsible for providing and installing all counter flashing. All openings in the roof shall be flashed and counterflashed. Use four-pound lead flashing materials for all vent lines and welded flashing in steel lines passing through roof. The Mechanical Contractor shall notify the General Contractor where each roof penetration is and the size of the opening.

1.22 PIPE SLEEVES

A. Schedule 40 steel pipe sleeves or pipe sleeves made of No. 20 gauge galvanized steel, properly secured in place with approximately 1/4" space between each sleeve and the surface of the pipe and/or insulation passing through it, shall be provided for all pipes passing through concrete floors, roofs, and masonry walls. All pipe sleeves shall be fixed in place as the walls and floors are built up. The Contractor shall furnish and locate all sleeves and pipes passing through concrete floors, exterior masonry walls, and roofs shall be made watertight with approved non-hardening plastic material. Sleeves through pipe chase or equipment room floors shall project a minimum of 2 inches above the floor and shall be of black steel pipe with waterproof flange at center of floor thickness. Each sleeve through a fireproof wall shall be packed with approved fireproof rope in the annular space.

1.23 PIPE HANGERS

A. Pipe hangers shall be Fee and Mason of a type suitable for each use. Perforated straps shall not be used in any work. For ferrous pipes up to and including 4 inches in size, use Fee and Mason Fig. 199 malleable iron, adjustable, split ring, swivel hanger. For plumbing piping larger than 4 inches, use Fee and Mason Fig 239 steel clevis hanger. Where several pipes are parallel at the same elevation, trapeze hangers may be used. Where trapeze hangers are used, the pipes shall be supported on rollers where indicated on the Drawings. For copper pipes up to and including 3 inches in size, use Fee and Mason Fig. 360 malleable iron, copper plated hangers. For copper pipes larger than 3 inches, use Fee and Mason Fig. 364 copper plated clevis hanger.

B. Hanger rod sizes shall conform to the following schedule:

1.	Pipe up to and including 2"	3/8" rods
2.	Pipe 2-1/2", 3" and 3-1/2"	1/2" rods
3.	Pipe 4" and 5"	5/8" rods
4.	Pipe 6"	3/4" rods
5.	Pipe 8”, 10”, and 12”	7/8” rods

C. Unless shown otherwise on the Plans, all horizontal runs of ferrous piping shall be suspended from the floor or roof construction, as the case may be, by means of hangers with the following spacing:

1.	Pipe up to and including 1-1/4"	8'
2.	Pipe 1-1/2" and 2"	10'
3.	Pipe 2-1/2" and 3"	12'
4.	Pipe 3 1/2” and 4”	14’
5.	Pipe 5” and 6”	16’
6.	Pipe 8” and 10”	20’

D. Unless shown otherwise on the Plans, all horizontal runs of copper piping shall be suspended from the floor or roof construction as the case may be, by means of hangers with the following maximum spacing:

1.	Pipe up to 3/4" in size	5'
2.	Pipe 1" and 1-1/4"	6'
3.	Pipe 1-1/2" and larger	10'

E. There shall be a hanger within 2 inches of each elbow or tee. Additional supports shall be provided for valves, strainers, etc. Cast iron pipe shall have not less than one hanger per length of pipe. Vertical risers shall be supported by approved riser clamps at each floor. Vertical pipes within a space shall have not less than two supports.

F. Supports and hangers shall be installed to permit free expansion and contraction in the piping systems. Hangers shall permit vertical adjustment to maintain proper pitch. Where necessary to control expansion and

contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting, nor shall it be supported from equipment connection.

G. Expansion bolts shall be Ackerman-Johnson or Hilti.

H. Beam clamps suitable for use with this type of steel construction involved shall be Grinnell.

1.24 PRESSURE VESSEL CERTIFICATION

A. Not used.

1.25 ISOLATION

A. Excessive vibration or objectionable noise created in any part of the building by the operation of any equipment furnished and/or installed under the Mechanical Contract will be extremely objectionable and the Contractor shall take all precautions against the same by isolating the various items of equipment from the building structure and by such other means as may be necessary to eliminate all excessive vibration and objectionable noise produced by any equipment installed by them, and consequently, they shall design all foundations, supports, etc., for their equipment, and all piping with this end in view. In addition, these Contractors shall supervise the construction of all foundations and supports, whether they build them or not, in order that they may be constructed in such a manner as to prevent the transmission of objectionable noise and/or excessive vibration. Submit calculations on all vibration isolation equipment.

B. All equipment having moving parts shall be isolated from the building structure by means of Korfund isolation materials, unless specifically noted otherwise. All isolators shall be the same brand and shall be supplied from the same source. Equipment manufacturer's recommendations shall be followed in the isolation of equipment.

C. Vibration isolators shall have sufficient resilience to meet the following minimum efficiencies:

Motor HP	Equipment Room
Up to 5	90%
7-1/2 to 15	93%
20 to 40	95%
50 to 100	97.5%

D. Spring isolators shall be of the housed type with ribbed pads bonded to the underside of the baseplate, or may be unhoused stable springs. Isolators shall be furnished with snubbers and limit stops where so recommended by the equipment manufacturer.

E. The Supplier of the isolating equipment shall, upon completion of the job, check all isolating materials and verify that they are installed properly, and submit a report in writing to the Architect/Engineer.

1.26 TESTING

A. Before completion of this project, the Mechanical Contractor shall test all materials and equipment which normally require testing. All piping, etc., shall be tested to meet code requirements or the Specification requirements, whichever is more stringent.

B. All equipment shall be operated sufficiently long enough to prove to the Architect/Engineer that the equipment performs satisfactorily and meets the requirements set forth on the Plans or in these Specifications.

1.27 CERTIFICATIONS

A. Before receiving final payment, the contractor shall verify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications. Submit certifications and acceptable certificates to the Architect/Engineer.

1.28 GENERAL PIPING INSTALLATION REQUIREMENTS

A. Provisions for Drainage: All piping systems shall be installed so that they may be easily drained. Drain caps, plugs, or hose bibbs shall be installed at low points. Grade piping toward drain locations.

B. Alignment: All installed pipelines shall be straight and shall remain straight against strains. Proper allowance shall be made for expansion and contraction.

C. Clean as Installed: All piping shall be kept free from scale or loose dirt when installed, and must be kept clean during the completion of the installation. All openings in the piping system shall be capped or plugged while awaiting further connections. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the system in which they are used. They shall not adversely affect the materials of mechanisms in the systems and they shall be acceptable to equipment manufacturers. All detergents, solvents, and other cleaning agents shall also be compatible with the process streams to be handled by the systems in which they are used.

D. Insulated Fittings: Install between any dissimilar metals such as steel and copper.

E. Expansion and Contraction: The Contractor shall make all necessary provisions for expansion and contraction with proper fittings, anchors, dresser couplings, loops, etc. Install flexible connectors on each pipe at each building expansion joint.

F. Welding: Refer to Paragraph 1.29 of this section of these specifications.

G. Bending: No bending of pipe will be permitted.

H. General: The installation shall be coordinated with respect to space available with heating, cooling, ventilating, and electrical installation. In every instance where there is a conflict in the routing of the piping and the ducting, the routing of the ducting shall govern. Installed piping shall not interfere with the operation or accessibility of doors or windows, shall not encroach on aisles, passageways, and equipment, and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping, installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping above ground shall be run parallel with the lines of the building unless otherwise noted on the drawings. Unless otherwise shown on the drawings, horizontal piping shall pitch down in the direction of flow with grade of not less than 1 inch in 40 feet. Piping connections to equipment shall be in accordance with details shown on the drawings or as recommended by the equipment manufacturer. Service pipe valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work, and not less than 1/2 inch between finished covering on the different services.

I. Installation of Valves: Valves shall be installed at the locations shown on the drawings and where specified and where directed at site. Gate valves shall be used unless otherwise shown, specified, or directed. All valves shall be installed with their stems horizontal or above. Where tight shutoff is required, a composition seat globe valve or resilient seat ball valve shall be used.

J. All valves which must be used during operation, all control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation shall be located conveniently accessible from an operating platform or grade.

K. In general, relief valves within processing unit limits shall be located conveniently accessible from an operating platform or grade.
   1. Those in non-hazardous service, such as water, shall discharge directly to outside.
   2. Relief valves should have no piping between the vessel or line and the valve inlet, except as shown on the drawings.
   3. Relief valves shall be installed in a vertical position. Vent piping shall be braced and supported in a manner that will not produce excessive stresses in the relief valve and will permit removal of the relief valve without necessary temporary supports for the vent lines.

L. Equipment Connections: All piping connections to pumps and other equipment shall be installed without strain at the pipe connection of the equipment. The contractor shall be required as directed to remove the bolts in flanged connections or disconnect piping to demonstrate that the piping has been so connected. Pipe connections to equipment shall be made with unions or flanged fittings. Provide removable headers for large equipment for service access.

M. Joints
   1. Flanged Joints: All flanged joints shall be face matched. Raised face flanges shall not be mated to flat-faced cast-iron flanges on valves or equipment. The raised face must be turned off. All flanged bolt holes shall straddle the horizontal and vertical center line unless otherwise noted.
   2. Screwed Joints: Screwed pipe joints shall have American Standard Taper Pipe Threads ANSI-B2.1 Latest Edition. Burrs formed when cutting pipe shall be removed by reaming. Care shall be taken that the inside of pipe is thoroughly clean and free of cutting oil and foreign matter before installation. Joints

shall be made perfectly tight by the use of Teflon tape or approved Teflon thread sealing and lubricating compound.

3. Solder-Joints: Tubing shall be cut square and burrs removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool or wire brush before seating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Joints for serrated fittings on water, compressed air below 60 psig, and vacuum lines shall be made with a 95 percent tin and 5 percent antimony. Cored solder or solder containing lead will not be permitted.

N. Reducers: Reduction in pipe size shall be made with one piece reducing fittings. Bushings reducing at least two pipe sizes will be acceptable only when there is no room for reducing couplings or swaged nipples.

O. Unions: All piping unions shall be of the ground joint type constructed from materials equivalent in alloy composition and strength to other fittings specified with which they are used. Union Pressure classes and end connections shall be the same as the fittings used in the lines with the unions. Steel unions shall have hardened stainless steel seating surfaces on both faces.

1.29 WELDING

A. All welding of piping covered by this specification, regardless of condition of service shall be accompanied as follows:

1. The welding shall be in accordance with the recommendations of the American Welding Society. Mitering of pipe to form elbows, notching to form these, or any similar construction will not be permitted. Welding fittings shall be installed on all welded lines. Joints to be welded shall be properly aligned and spaced, using special welding clamps where necessary. All welders to be employed shall have passed qualification tests prescribed by the National Certified Pipe Welding bureau (or by another reputable testing laboratory or agency) using procedures approved by the American Society of Mechanical Engineers or the American Welding Society. The welders will be required to pass qualification tests when the work of the welder creates a reasonable doubt as to their proficiency. Tests shall be conducted at no additional expense to the Owner.
2. Each welder shall, in addition to having passed the prescribed qualification tests (as noted in Paragraph 1.29.A.1), prepare sample coupons at the job site on a portion of pipe that is cut such that the cross section of the weld is open to view. The sample weld should be prepared using a 6 inch diameter pipe. The sample shall reflect a continuous weld with perpendicular cut out to show the weld in cross sectional view. This sample, when accepted and approved by a certified welding inspector, shall be used as a standard of quality to compare to other welds that this welder will be performing on the job. This same sample weld will also be a basis for accepting or rejecting the welder for working on this project. The sample weld shall be identified with a date and the welder's name and shall be kept at the site throughout the project.
3. All welding on pressure piping shall conform to all of the requirements of the American Society of Mechanical Engineers Code for Pressure Piping - B31.1 (An American National Standards Institute publication), as defined in the latest edition of the ANSI Power Piping B31.1 Manual. All welding shall also conform to all of the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. All chapters, current addenda and supplements of these manuals shall apply. This code shall be used to establish standards of performance and quality of welds. However, the Owner reserves the right to perform radiographic testing of all welds, to compare any of the welds to the approved "standard" sample welds of each welder, and to compare the welds to the welding diagrams and sketches of those recommended in the ANSI B31.1 Power Piping Manual. The intent is to obtain the highest quality welding job possible. The cost of any initial radiographic testing, for random inspection, shall be paid for by the Owner. If radiographic random testing reveals that a weld is defective, the Contractor shall bear the cost of all repairs and re-testing necessary to be made to subject weld until conformance with radiographic tests is reached. The potential for random radiographic testing and welding quality control applies to all pressure piping systems in this project, including systems below 100 psig. If a question should arise regarding the possibility of faulty welding or if there are obvious visual defects in the welding, the Contractor shall be required to correct such deficiencies to a quality level consistent with the recommendations, welding diagrams and sketches in the ANSI B31.1 Manual. The quality level shall also reflect that of the approved sample welds accomplished by each welder for this particular project.

1.30 COOPERATION WITH OTHER TRADES

A. The Contractor shall refer to other sections of these specifications covering the work of other trades which must be carried out in conjunction with the mechanical work so that the construction operations can proceed without harm to the Owner from interference, delay, or absence of coordination.

1.31 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions covering the mechanical work at the building. No extra compensation shall be claimed or allowed on account of difference between actual dimensions and those indicated on the drawings. They shall examine the adjoining work on which Mechanical work is dependent for maximum efficiency, and shall report any work which must be corrected. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting Mechanical work.

1.32 SAFETY GUARDS

A. The Mechanical Contractor shall furnish and install safety guards required in order to obtain certificates of inspection from all authorities having jurisdiction. All belt driven equipment, projecting shafts, and other rotating parts shall be enclosed or adequately guarded. Provide coupling guards on all rotating shafts.

1.33 PROTECTION

A. All work, equipment, and materials shall be protected at all times to prevent obstruction, damage, or breakage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected against dirt, water, chemical, or mechanical injury. At the completion of the work, all equipment shall be thoroughly cleaned, and the entire system shall be delivered in a perfect, unblemished condition.

1.34 PAINTING AND IDENTIFICATION

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be marred in transit or during installation, it shall be finished to present a neat, workmanlike appearance.

B. Except as elsewhere hereinafter specifically required, any painting of equipment, piping, ductwork, grilles, insulation, etc., furnished and installed under this Section of the Specifications will be done by the Painting Contractor. However, the Mechanical Contractor shall leave their equipment clean and free from any grease, dirt, rust, etc., and in suitable condition for painting.

C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.

D. The piping shall be painted the basic color as indicated in other sections of these specifications and shall be marked every 10 feet on centers with Brady pipe markers. Arrows, approximately 6 inch in length and spaced about 10 feet on centers shall indicate the direction of the flow pipe. Locate additional labels as required in Mechanical Rooms. Staple in place, brush with clear lacquer. Markers shall state pipe size, flow direction, and pipe usage (such as "cold water," etc.).

1.35 RECORD DRAWINGS

A. The Contractor shall, during the execution of the work, maintain a complete set of drawings upon which all dimensional locations of equipment piping and all deviations and/or changes in the work shall be recorded. Water, storm, and drainage mains shall be delivered to the Architect/Engineer in good condition upon the completion and acceptance of the work and before final payment is made.

1.36 SUPPLIER RESPONSIBILITY

A. Each supplier, whether furnishing equipment as specified or as a substitution shall be responsible for certifying that the equipment is properly installed and that the warranty is valid. Submit written reports on the installation and the equipment performance when requested to do so by the Architect/Engineer (or their representative). Each supplier shall be responsible for furnishing qualified personnel at the job site at any time requested by the Architect/Engineer (or their representative) during the construction or warranty periods.

END OF SECTION

SECTION 25 09 00 MECHANICAL SYSTEM INSTRUMENTATION AND CONTROL

PART 1 - GENERAL

1.1 RELATED SECTIONS

23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
25 11 00	ELECTRICAL CONTROLS AND INTERLOCKS
25 30 00	CONTROLS AND INSTRUMENTATION
26 05 00	GENERAL ELECTRICAL PROVISIONS
26 05 19	LOW VOLTAGE CONDUCTORS
26 05 26	GROUNDING
26 05 33	RACEWAYS, BOXES AND FITTINGS
26 27 26	WIRING DEVICES AND PLATES
26 29 00	MOTOR STARTERS

1.2 REFERENCES

A. American National Standards Institute (ANSI)
   1. ANSI/ISA 5.5-1985 Graphic Symbols for Process Displays.
   2. ANSI/IEEE 260.1 2004, Standard Letter Symbols for SI and Certain Other Units of Measurements (SI Units, Customary Inch-Pound Units, and Certain Other Units).
   3. ANSI/ASHRAE 135-2016, BACnet - A Data Communication Protocol for Building Automation and Control Networks including the latest addenda.

1.3 ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

A. Acronyms used in this specification:
   1. DDC – Direct Digital Controls
   2. Controls System - DDC Control System
   3. EMCS – Energy Management and Control System
   4. GUI – Graphical User Interface
   5. HVAC - Heating, Ventilation, Air Conditioning
   6. I/O - Input/output
   7. ISA - Industry Standard Architecture
   8. O&M - Operation and Maintenance
   9. FCU – Field Control Unit
   10. BCU – Building Control Unit
   11. NCU – Network Control Unit
   12. LSI – Local System Interface
   13. VFD - Variable Frequency Drive
   14. Contract Document(s) – Drawings, specifications, equipment submittals, and all other documentation involved in this project.

1.4 PERMITS AND FEES

A. Per General Conditions of Contract.

B. Submit certificate(s) of acceptance as applicable from authorities having jurisdiction to the Owner.

1.5 GENERAL DESCRIPTION

A. Refer to control schematics on contract documents for all required contract points.

B. Work covered by sections referred to above consists of fully operational controls system, including, but not limited to, following:
   1. Control devices as listed in I/O Summaries.
   2. Peripheral devices.
   3. Complete operating and maintenance manuals and field training of operators, programmers, and maintenance personnel.
   4. Acceptance tests, technical support during commissioning, full documentation.
   5. Wiring interface co-ordination of equipment supplied by others.
   6. Miscellaneous work as specified in these sections and as indicated.
   7. Connection to all equipment through MSTP or IP Addresses in equipment controllers.

1.6 STANDARDS COMPLIANCE

A. All equipment and material to be from manufacturer's regular production, UL and/or ULC certified, manufactured to standard quoted plus additional specified requirements.

B. Where UL and/or ULC certified equipment is not available to submit such equipment to inspection authorities for special inspection and approval before delivery to the site. Obtain approvals prior to bid date.

C. Submit proof of compliance to specified standards with shop drawings and product data. A label or listing of the specified organization is acceptable evidence prior to bid date.

D. For materials whose compliance with organizational standards/codes/specifications is not regulated by an organization using its listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

E. Installation shall be in accordance with national, state and local building and electrical codes as may be in force in the installation area.

1.7 WORK INCLUDED

A. Provide a new building automation and control system to control and monitor the building's mechanical systems.

B. Provide control valves, control dampers (gravity, fire and smoke control dampers by others), flow switches, thermal wells for temperature control, and air flow stations as required by contract documents.

C. Provide Variable Frequency Drives (VFD) for HVAC equipment as specified herein. VFD shall be provided to match equipment shown on the drawings. No generic submittal will be approved unless all characteristics are provided for each piece of equipment.

D. Provide submittal data sheets tagged specifically to each system point, control drawings schematics (AutoCAD), data entry, and electrical installation, programming, start-up, test and validation acceptance documentation, as-built documentation, maintenance manuals, and system warranties. All sequence of operation shall be adhered to and all materials noted shall be provided, no exceptions.

E. All labor, material, equipment, and services not specifically referred to in this specification or on associated drawings that are required to fulfill the functional intent of this specification shall be provided at no additional cost to the Owner.

F. The work covered by this specification and related sections consists of providing shop drawings, equipment, labor, materials, engineering, technical supervision, and transportation as required to furnish and install a fully operational mechanical BACnet control system to monitor and control the facilities listed herein, and as required to provide the operation specified in strict accordance with these documents, and subject to the terms and conditions of the contract. The work in general consists of but is not limited to, the following:
   1. The preparation of submittals and provision of all related services.
   2. Furnish and install all components to achieve system operation, any control devices, conduit, and wiring, in the facility as required to provide the operation specified.
   3. Furnish complete operating and maintenance manuals and field training of operators, programmers, and maintenance personnel.
   4. Perform acceptance tests and commissioning as indicated.
   5. Provide full documentation for all applications and equipment.
   6. Miscellaneous work as indicated in these specifications.

1.8 WORK BY OTHERS

A. Setting in place of valves and dampers, access doors, flow meters, water pressure, and differential taps, flow switches, thermal wells, fire and smoke control dampers, current sensors, air flow stations, etc. shall be by others.

B. Duct smoke detectors shall be provided under Division 26. Connection of auxiliary terminals of duct smoke detectors shall be wired to the controls system for monitoring purposes only by this section. See Specification section 253000 for coordination.

C. High and low temperature thermostats shall be provided by this section.

D. Switches, and power wiring to motors, starters, thermal overload switches, and contactors, are specified in Division 26. This Section includes the furnishing and installation of controls and wiring for automatic controls, electric damper and valve operators, terminal control units, interlocks, starting circuits, and wiring to power consuming control devices.

1.9 OPEN SYSTEM DESIGN AND QUALIFICATIONS

A. Objective for an open controls system: The Owner aims to establish an open controls system that supports integration of diverse products from various manufacturers or suppliers. This approach is intended to facilitate system expansion, maintenance, and servicing. The controls provider must demonstrate adherence to the open system criteria detailed below.

B. Pre-Contract Requirements for Open System Design:
   1. Local Presence and Experience: The controls provider should present evidence of operating a local office within 150 miles of the project site for a minimum of five years. This office must be staffed with professionals skilled in installation, engineering, programming, service, commissioning, training, routine upkeep, and emergency response related to the systems.
   2. Software Framework: The control system must employ the Niagara4 software framework, with the contractor having at least two years of experience in various aspects of Niagara4 handling. Additionally, a Niagara Compatibility Statement (NiCS) should be provided, confirming unrestricted connectivity and complete access to the Niagara Framework, ensuring an open system. The NiCS should verify compatibility in various aspects.

C. Communication Protocols Compliance:
   1. System controllers must utilize BACnet. The suppliers of both hardware and software must be active members of BACnet International, with controllers being BACnet Listed (documentation available on the BACnet website).
   2. BACnet alone does not qualify as an open system. Full adherence to the specified open system and manufacturer requirements is necessary.
   3. Modbus is acceptable only for third-party devices.
   4. LonTalk is **not** permissible.
   5. Proprietary communication protocols are not acceptable.

D. Software Programming Tool Provisions:
   1. The project must include necessary software tools for complete functional use of the controls system, including programming, network management, and interface development.
   2. The programming tool must include a one time-purchase option that includes a non-expiring license.
   3. The programming tool must include the ability to be freely updated by the owner without additional purchase requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SYSTEM MANUFACTURERS AND CONTRACTORS

A. The supplier must be a company with at least five years of experience in manufacturing and distributing DDC Control Systems.

B. The hardware and software manufacturer must offer a technical support service accessible via a toll-free number, staffed with qualified personnel for providing instructions and technical support for networked control systems.

C. Acceptable Manufacturers:
   1. ABB (Basis of Design)

2.2 QUALITY ASSURANCE

A. All new DDC Control System products on this project shall be provided by a firm that is a registered ISO 9001:2015 manufacturer, for a minimum duration of 5 years, at time of bid.

B. The DDC Control System shall be furnished, engineered, installed, tested and calibrated by factory certified technicians qualified for this work. The contractor shall be Factory Authorized in good standing with the Manufacturer. Factory-trained technicians shall provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of the request.

2.3 COMPUTER HARDWARE

A. Provide the following computer hardware for this project:
   1. Onsite Server(s)
   2. Workstation Computer(s)
   3. Uninterruptable Power Supplies

B. Server Hardware Requirements:
   1. The Server shall be a PC with minimum Intel i7 Quad-core 7 GHz processor with 16 GB RAM and a minimum of 250 GB SATA or SAS RAID Array (RAID 1 with hot spare suggested). It shall include a minimum of 4 USB ports. A minimum 21”, HDMI, DVI-D video interfaces, minimum 1024 x 768 resolution, 4x3 Widescreen, LED color monitor with a minimum 60 Hz refresh rate shall also be included.
   2. The server operating system shall be VMware ESXi v5.0 or newer with VM support and with the most recent service packs and system updates.
   3. Acceptable Manufacturers are:
      a. Dell
      b. Lenovo
      c. HP (Hewlett Packard)
   4. Connection to the controls LAN network shall be via an Ethernet network interface card, 100/1000 Mbps.
   5. The server will be located in the IT Closet - coordinate with Owner prior to installation.
   6. The server shall support all Network Control Units (NCU), OWS(s), and 3rd party mechanical/electrical systems connected to the Facility Management Control / Building Management System Local Area Network.

C. Uninterruptable Power Supplies
   1. Provide the OWS, Server, and each network/building controller with individual UPS to provide clean, reliable, noise-filtered power at all times and to protect and maintain systems operation throughout short term power interruptions of up to 15 minutes duration.
   2. Acceptable Manufacturer: APC

2.4 REMOTE ACCESS AND CYBER SECURITY

A. Remote Access:
   1. The controls contractor must adhere to the owner's IT infrastructure security policies for remote access. The owner's IT team will provide necessary elements like VPN and firewalls for secure remote access.
   2. Secure remote access should always utilize a VPN and firewall.

B. Cyber Security:
   1. Unless specified by the owner's IT team, the controls network should be separate from the owner's IT infrastructure, except for a single connection point for remote access (internet access provided by the owner). The controls contractor is responsible for providing all necessary ethernet switches and communication backbones to ensure a fully operational control system.
   2. Refer to the “Communication Backbone” section of this specification for detailed guidelines on network segmentation (VLANs, subnets), and requirements for edge or managed switches depending on building size/type.
   3. Avoid using default factory usernames and passwords. Regularly update usernames and passwords to ensure strong system security.
   4. Regularly update all software and firmware.
   5. Follow the control manufacturer's system hardening guidelines where applicable.

2.5 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2016, BACnet.

B. Provide wiring and network devices for a complete and workable control network.

C. Internetwork operator interface and value passing shall be transparent to internetwork architecture. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.

D. Controllers with real-time clocks shall use the BACnet Time Synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. The system shall automatically adjust for daylight saving and standard time if applicable.

E. BACnet/IP communication protocol shall be used for all controls manufacturer provided Network Control Units (NCUs). Building Control Units (BCUs) and Field Control Units shall use either BACnet/IP or BACnet MS/TP where specified.
   1. All controllers shall have the ability communicate peer-to-peer without the need for a NCU as necessary.
   2. Any controller on the Ethernet Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected to the same communication cabling. Slave controllers are not acceptable
   3. Provide industry standard IP switches, routers, and other network devices as required.

2.6 INTEGRATION PLATFORM (NCU)

A. Shall be comprised of Java Application Control Engine or Controllers (JACE) within each facility. The NCU shall connect to the owner's local network, wide area network, or operational technology network depending on the configuration. Each NCU is capable of communicating to LonMark and BACnet controllers and other open and legacy protocol systems.

B. Shall support storing local backups and retention of setpoints of all MS/TP controllers connected to its fieldbus. Controllers shall be capable of being replaced and restored to operating conditions with last saved setpoints through the web server without launching programming software.

C. Shall be capable of launching the programming software directly from the project tree for the Building Control Units (BCUs) and Field Control Units (FCUs) for access to the control logic.

D. Shall include the ability to import a single database file in .JSON format from the BCU/FCU programming software that includes:
   1. Point Naming
   2. Facets
   3. Addressing and

E. Acceptable Technologies:
   1. Supervisory Control Software: ABB INTEGRA based on the Niagara Framework
   2. Engineering Software: ABB INTEGRA Workbench
   3. NCU: ABB IT-9000

2.7 IOT SERVER SOFTWARE

A. The IoT Server Software shall allow multiple Integra-based IT-9000 controllers, along with other IP-based controllers, to be networked together through the Enterprise OT Network. This software shall provide real-time graphical information to standard Web-browser clients and provide server-level functions. These functions include centralized data logging/trending, alarming, tagging, archiving to external databases, alarming, dashboarding, system navigation, master scheduling, database management, and integration with other enterprise software applications through custom APIs where required. A comprehensive graphical engineering toolset for application development shall be provided (Integra 4 Workbench)

B. The controls Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The controls server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.

C. The intent of the thin-client architecture is to provide the operator(s) complete access to the control system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. Microsoft, Firefox, and Chrome browsers (current released versions), and Windows as well as non-Window operating systems. All browsers shall comply with the owner's IT standards.

D. The controls server software shall support at least the following server platforms (Windows 11 x64-bit; Windows Server 2022 and 2019; Linux x64-bit: RedHat Enterprise Linux 8.7, Ubuntu 22.04). The control server software shall be developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.

E. Graphical User Interface (GUI): The controls platform shall provide the Single Pane of Glass that displays all building, integrated building, and building-related information for: monitoring, management, and control. The GUI shall be browser-based utilizing HTML5 graphics with responsive web design (RWD) graphics for multi-platform support:
   1. Trending.
   2. Scheduling.
   3. Electrical demand limiting.
   4. Energy Aggregation and Analytics.
   5. Downloading Memory to field devices.
   6. Real time 'live' Graphic Programs.
   7. Tree Navigation.
   8. Parameter changes of properties.
   9. Set point adjustments.
   10. Alarm / event information.
   11. Configuration of operators.
   12. Execution of global commands.
   13. Add, delete, and modify graphics and displayed data.

F. Software Components: All software shall be the most current version. All software components of the controls system software shall be provided and installed as part of this project. Controls system software components shall include:
   1. Server Software, Database and Web Browser Graphical User Interface.
   2. 5 Year Software Maintenance license. Labor to implement not included.
   3. Embedded Configuration Utilities for future modifications to the system and controllers.
   4. Embedded Graphical Programming Tools.
   5. Embedded Direct Digital Control software.
   6. Embedded Application Software.

G. Controls Server Database: The controls server software shall utilize a Java Database Connectivity (JDBC) compatible database such as: Niagara standard database, MS SQL 8.0, Oracle 8i or IBM DB2. Owner’s IT will provide any non-Niagara DB licenses if required.

H. Thin Client - Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:
   1. Web Browser's for PC's: Only the current released browser (Explorer/Firefox/Chrome) will be required as the GUI and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over secured owner’s Operational Technology Network.
   2. Secure Socket Layers: Communication between the Web Browser GUI and controls server shall offer encryption using 128-bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be TLS 1.3

I. Web Browser Graphical User Interface
   1. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic set point controls, configuration menus for operator access, reports and reporting actions for events.
   2. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control privileges.
   3. Navigation: Navigation through the GUI shall be accomplished by clicking on the appropriate level of a navigation tree (consisting of an expandable and collapsible tree control and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
      a. Geographic View shall display a logical geographic hierarchy of the system including cities, sites, buildings, building systems, floors, equipment, and objects.
      b. Groups View shall display Scheduled Groups and custom reports.
      c. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

4. Action Pane: The Action Pane shall provide several functional views for each subsystem specified. A functional view shall be accessed by clicking on the corresponding button:
   a. Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floorplans, equipment drawings, active graphic set point controls, web content and other valid HTML elements. The data on each graphic page shall automatically refresh.
      1) Dashboards: User customizable data using drag and drop HTML5 elements. Shall include Web Charts, Gauges, and other custom developed widgets for web browser. User shall have ability to save custom dashboards.
      2) Search: User shall have multiple options for searching data based upon Tags. Associated equipment, real time data, Properties, and Trends shall be available in result.
      3) Properties: Shall include graphic controls and text for the following: Locking or overriding objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an 'accept/cancel' button.
      4) Schedules: Shall be used to create, modify/edit and view schedules based on the systems hierarchy (using the navigation tree).
      5) Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.
      6) Charting: Shall be used to display associated trend and historical data, modify colors, date range, axis, and scaling. User shall have ability to create HTML charts through web browser without utilizing chart builder. User shall be able to drag and drop single or multiple data points, including schedules, and apply status colors for analysis.
      7) Logic - Live Graphic Programs: Shall be used to display' live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.
      8) Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.

J. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to set points and comfort. Animated. gifs or .jpg, vector scalable, active set point graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
   1. Display Size: The GUI workstation software shall graphically display in a minimum of 1024 by 768 pixels 24-bit True Color.
   2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
   3. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective set points. The colors shall be updated dynamically as a zone's actual comfort condition changes.
   4. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone using a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability.
   5. All graphics shall be compatible with any desktop, mobile device or tablet.
   6. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
   7. Each piece of equipment monitored or controlled including each terminal unit.
   8. Each building.
   9. Each floor and zone controlled.
   10. See System Integration Matrix for details.

K. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with proper access credentials) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day ' Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the ' Independence Day' Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
   1. Schedules: Schedules shall comply with the BACnet standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
      a. Types of schedules shall be Normal, Holiday or Override.
      b. A specific date.
      c. A range of dates.

d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any).
e. Wildcard (example, allow combinations like second Tuesday of every month).

2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of "things" to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
3. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an 'individual tenant' group - who may occupy different areas within a building or buildings. Schedules applied to the ' tenant group' shall automatically be downloaded to control modules affecting spaces occupied by the ' tenant group'.
4. Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
5. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
6. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

L. Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ' Alarms' view. Alarms, and reporting actions shall have the following capabilities:
1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address, and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge, or force a return to normal in the Events View as specified in this section.
2. Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
3. Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
4. Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.
5. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
6. Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A ' network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.
7. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement and total number of Alarms in the Controls Server database.
8. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
9. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the controls server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
   a. Print: Alarm information shall be printed to the control server's PC or a networked printer.
   b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
   c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point

information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
d. Write Property: The write property reporting action updates a property value in a hardware module.
e. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
f. Run External Program: The Run External Program reporting action launches specified program in response to an event.
g. Provide alarm recipients and escalation per direction from owner.

M. Trends: As system is engineered, all points shall be enabled to trend. Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the NWS server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
3. Resolution. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis. (see point list for details)
4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
5. Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and ' pan through' historical data by simply scrolling the mouse.
6. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
7. Copy/Paste. The operator shall have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).

N. Security Access: Systems Access from the web browser GUI to controls server shall require a Login Name and Strong Password. Access to different areas of the controls system shall be defined in terms of Role-Based Access Control privileges as specified:
1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of ' easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
b. Edit Privileges shall comprise: Set point, Tuning and Logic, Manual Override, and Point Assignment Parameters.
c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.
2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

2.8 BUILDING UNIT CONTROLLER AND FIELD UNIT CONTROLLER

A. All BCUs and FCUs (which includes controllers for terminal devices such as VAVs, DOAS, exhaust fans, etc.) must be listed with the BACnet Testing Laboratory (BTL). The minimum following requirements shall be met as specified:
1. BACnet/IP Controllers
a. Support for IPv4.
b. DHCP and static IP addressing.
c. 2 – RJ45 ports each capable of supporting 10/100 Base-T.
d. Shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L.
e. Shall have an embed web-based HTML5 visual interface without reliance on another other controller for access.
f. Should the FCU memory be lost for any reason, the user shall have the capability of reloading the controller software via the controls LAN OWS or Server.
1) Controllers requiring a local port to reload the controller software are not acceptable.
g. Acceptable Products:
1) ABB FLXeon Series

2. BACnet MS/TP
   a. Shall conform to Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L.
   b. Shall include selectable baud rate as determined by project requirements.
   c. Acceptable Products:
      1) ABB CB Series
3. Memory
   a. Controller memory shall support an operating system, database, and programming requirements.
   b. Controllers shall be capable of retaining setpoint data in the BACnet priority array upon loss of power and controller reboot.
   c. BACnet/IP Building Control Units shall support storing local backups and retention of setpoints of all MS/TP controllers connected to its fieldbus. Controllers shall be capable of being replaced and restored to operating conditions with last saved setpoints through the web server.
4. Inputs/Outputs
   a. Support for digital inputs from dry contact closure, pulse accumulators, and voltage sensing.
   b. Support for analog inputs of 4-20 mA, 0-10 VDC, thermistor and RTD in the range of 350,000 ohm.
   c. Support for Universal I/O that can serve as either an analog or digital input/output.
   d. Each controller serving equipment shall have a minimum of spare points of each point type (10% spare capacity).
5. Controller Software
   a. All controllers must share a single software tool for block based programming.
   b. Shall be fully programmable and the programming software shall have a library of pre-built, tested, and user re-definable control sequences for a wide range of typical HVAC applications.

B. Building Control Units (BCUs):
1. Provide for equipment control (Central plant, air handlers, boiler systems, exhaust fans, etc.)
2. Shall include optional on-board Hand-Off-Auto switches for analog and digital inputs/outputs with software configurability.
3. Each BCU shall have the capability to accept Expansion I/O Modules to accommodate additional point capacity.
   a. Each Expansion I/O Modules shall have the ability to be locally or remote mounted up to 100 feet.
   b. Remote mounting distance must be capable of being extend with the use of additional power supply modules.
   c. Support for digital inputs from dry contact closure, pulse accumulators, and voltage sensing.
   d. Support for analog inputs of 4-20 mA, 0-10 VDC, thermistor and RTD in the range of 350,000 ohm.
   e. Support for Universal I/O that can serve as either an analog or digital input/output.
   f. Optional on-board Hand-Off-Auto switches for analog and digital outputs with software configurability, LED status indicates and monitoring.
4. BACnet/IP BCUs with BACnet B-BC profile:
   a. Shall be 32-bit microprocessor-based operating at a minimum of 1 GHz.
   b. Shall have a minimum of 512MB memory, and a minimum of 4GB non-volatile flash to support its operating system, connectivity and databases.
   c. All control sequences programmed into the BCU shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
   d. Shall have a real-time clock.
   e. In addition to providing local monitoring and control of equipment, the following routing capabilities shall be available:
      1) BACnet/MSTP to BACnet/IP
      2) Modbus/RTU to Modbus/TCP
   f. Shall support storing local backups and retention of setpoints of all MS/TP controllers connected to its fieldbus. Controllers shall be capable of being replaced and restored to operating conditions with last saved setpoints through the web server without launching programming software.
   g. Shall include a dual-port, integrated ethernet switch.
5. BACnet MS/TP BCUs with BACnet B-AAC profile:
   a. Shall be 32-bit microprocessor-based operating at a minimum of 72 MHz.
   b. All control sequences programmed into the BCU shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
   c. Shall have a real-time clock.
   d. In addition to providing local monitoring and control of equipment, the following routing capabilities shall be available:
      1) Modbus/RTU

C. Field Control Units (FCUs):
1. Provide unitary equipment control (VAV, fan coils, heat pumps, RTUs, etc).
2. BACnet/IP FCUs with BACnet B-BC profile
   a. BACnet/IP FCU shall be 32-bit microprocessor-based operating at a minimum of 600 MHz.

b. Each BACnet/IP FCU shall have a minimum of 512MB memory, and a minimum of 4GB non-volatile flash to support its operating system, connectivity and databases.
c. All control sequences programmed into the FCU shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
d. Shall have a real-time clock.
e. Shall include a dual-port, integrated ethernet switch to support pass through on daisy chaining to prevent network communication loss.
f. Communications port shall additionally support Modbus/RTU integration of devices up to 320 points.

3. BACnet/IP FCUs with BACnet B-AAC profile
   a. Shall be 32-bit microprocessor-based operating at a minimum of 72 MHz.
   b. All control sequences programmed into the BCU shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
   c. Shall have a real-time clock.
4. Shall be fully programmable and the programming software shall have a library of pre-built, tested, and user configurable control sequences for a wide range of typical HVAC applications.
5. Shall have a communications port for connecting a smart sensor capable of monitoring temperature, humidity, and/or CO2 without utilizing any of the I/O points of the Controller.
6. Variable Air Volume (VAV) and laboratory air valves:
   a. The VAV and air valves actuator shall be a Belimo Smart Actuator with intelligent position feedback for real-time position indication.
   b. The BACnet/IP controller shall include an integrated bi-directional pressure sensor for measuring airflow.
      1) Singe point differential pressuring sensing devices are not acceptable.
      2) Differential pressure transducers requiring periodic zero value airflow calibration is not acceptable.
   c. The controller shall support test and balance through a freely downloadable mobile application.
      1) Mobile application for TAB purposes shall interface to the controller either through Bluetooth Low Energy (BLE) or a Wi-Fi connection.

2.9 OCCUPANT CENTRIC BLUETOOTH LOW ENERGY (BLE) SENSORS [COMPATIBLE WITH MOBILE APPLICATIONS]

A. BLE-Enabled Multi-Sensor
1. Shall communicate with any ABB FLXeon or CB Series controller and provide precise environmental zone values temperature, humidity, and CO2 (dependent upon sensor options selected) as well as Bluetooth low energy connectivity. The sensor shall be capable of being daisy chained on controller communicating subnet via RS-485 connection.
   a. Up to 10 devices on a FLXeon Series controller.
   b. Up to 4 devices on a CB Series controller.
2. Each sensor shall provide the following minimum features:
   a. Variable backlight
   b. Capacitive touch screen
   c. Programmable RGB indication
   d. The sensor shall be capable of displaying the following elements:
      1) Space temperature
      2) Space relative humidity
      3) Space CO2
      4) Cooling space temperature setpoint
      5) Heating space temperature setpoint
      6) Current heating or cooling mode
      7) Current occupancy mode
      8) Outdoor air temperature
      9) Current time
3. Each sensor shall provide a capacitive touchscreen for a local user interface to perform navigation and adjustment of points configured as adjustable.
4. Each sensor shall provide at a minimum the following onboard integral I/O without the consumption of any inputs and/or outputs at the host controller:
   a. Temperature Sensor
      1) Sensing Element: 10k Type III Thermistor
      2) Accuracy: ±0.36 ˚F
      3) Range: 40 ˚F to 104 ˚F
   b. Relative Humidity Sensor
      1) Accuracy: ±3 % RH
      2) Range: 0% to 100%
   c. Space CO2
      1) Range: 0 to 2000 PPM

2) Accuracy ±40 PPM + 5% of reading
d. Dry Contact Digital Inputs
1) 2 digital volt-free contact
2) 11 mA contact-wetting current
5. Acceptable Products:
a. ABB FusionAir Smart Sensor

2.10 LOCAL SYSTEM INTERFACE (LSI)

A. A wall or IP65 rated panel mounted capacitive 7” (17.8cm) or 10” (25.4cm) touch-screen display that provides direct read/write access to any point on the network.

B. The LSI shall provide the following:
1. Consist of an alphanumeric and a multi-function intelligent keyboard.
2. Support user authentication.
3. Support connectivity to any NCU/BCU connected on the same IP network.
4. Have a configurable graphical logo displayed on its default screen. This logo shall be a standard monochrome bitmap of 89 x 128 pixels that the user can replace.
a. Configuration of the display shall be made available within the system programming tools.
5. Access through simple to use directional and entry buttons.

C. The LSI shall be provided with a power adapter port and one RJ45 Ethernet port.

D. Provide LSI(s) as shown on the mechanical drawings.

E. Provide 10" (25.4cm) LSI(s) at each mechanical room panel (surface mount on face of panel).

F. Acceptable Products:
1. ABB eXplore Series

2.11 CONTROL PANELS

A. Indoor control cabinets located in offices or dry/dust free environments shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.

B. All outdoor control cabinets and control cabinets located in mechanical/electrical rooms shall be NEMA 4.

C. Control panels containing more than 4 controllers shall be provided with a terminal strip for field wiring. All control wiring inside the panel shall be between a terminal strip and controller inputs/outputs. All field control wiring shall be terminated at the terminal strip. Field control wiring inputs/outputs shall not be run directly to inputs/outputs of controller.

2.12 VARIABLE FREQUENCY DRIVES (VFDS)

A. Provided by Controls Contractor

2.13 AUTOMATIC CONTROL DAMPERS

A. Controls Integration by Controls Contractor. See contract documents.

2.14 AUXILIARY CONTROL DEVICES, SENSORS, AND TRANSMITTERS

A. Sensor Accuracies
1. Minimum acceptable reporting accuracies outlined below unless stated otherwise:

a. Air Temperature	±1°F [±.0.5°C]
b. Water Temperature	±1°F [±.0.5°C]
c. Delta –T	±0.25°F[±0.15°C]
d. Relative Humidity	±5% RH
e. Water Flow	±2% of full scale
f. Air Flow (terminal)	±10% of reading
g. Air Flow (measuring stations)	±3% of reading
h. Air Pressure (ducts)	±0.1 “W.G. [±25 Pa]
i. Air Pressure (space)	±0.01 “W.G.[±3 Pa]

j.	Water Pressure	±2% of full scale
k.	Electrical Power	5% of reading
l.	Carbon Dioxide (CO_2)	± 75 PPM

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

A. Installation to be to manufacturer's recommendations and contract documents. Provide printed copies of recommendations with shop drawings or product data.

3.2 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.3 FIELD QUALITY CONTROL

A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances.

B. Continually monitor field installation for code compliance and workmanship quality.

C. Contractor shall arrange for work inspection by authorities having jurisdiction over the work.

3.4 WIRING

A. Control and interlock wiring and installation shall comply with national and local electrical codes. Where the requirements of this Section differ from other Divisions, this Section shall take precedence.

B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC. All wiring for the entire controls system shall be in conduit - minimum size 3/4 inches, no exceptions.

C. Low-voltage wiring shall meet NEC Class 2 requirements. Sub fuse low-voltage power circuits as required to meet Class 2 current limit.

D. NEC Class 2 (current-limited) wires shall be in raceway UL listed for the intended application.

E. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

F. Use structural members to support or anchor conduits with cables. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

G. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

H. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.
   1. Include one pull string in each raceway 1" or larger.

I. Use color-coded conductors throughout.

J. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

K. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 6" between raceway and high-temperature equipment such as steam pipes or flues.

L. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

M. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

N. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

O. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3ft in length and shall be supported at each end. Do not use flexible metal raceway less than 1/2" electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.

P. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.5 COMMUNICATIONS WIRING

A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring).

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

D. Verify entire network's integrity following cable installation using appropriate tests for each cable.

E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available.
   1. Runs that are longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

G. Label communication wiring to indicate origination and destination.

H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.6 FIBER OPTIC CABLE

A. Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125 µm.

B. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

C. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.

D. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable and unjacketed fiber bend radii specified by cable manufacturer.

3.7 SUBMITTALS

A. Schematic diagram of each controlled system and every piece of equipment shown on contract documents. Label control points with point names.

B. Bill of Material for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number. Provide wire and wire size.

C. Specification sheets for each item including manufacturers descriptive literature, drawings, diagrams, performance and characteristic curves, manufacturer and model number, size, layout, dimensions, capacity, etc.

D. Control schematics with narrative description and control descriptive logic fully showing and describing operation and/or manual procedures available to operating personnel to achieve proper operation of the building, including under complete failure of the controls system.

E. Shop drawings for each input/output point showing all information associated with each particular point including sensing element type and location; details of associated field wiring schematics and schedules; point address; software and programming details associated with each point; and manufacturer's recommended installation instructions and procedures for each type of sensor and/or transmitter.

F. Riser diagrams showing control network layout, communication protocol, and wire types.

G. Network diagram of control, communication, and power wiring for controls Server and OWS installation.

3.8 AS-BUILT DOCUMENTATION

A. As-built documentation shall consist of 4 hard copies and one soft copy for all information described below

B. The final documentation package shall include:
   1. As-built Submittals: Final as built control submittals and technical data sheets.
   2. Programming, Sequences, and Graphics: All programming, sequences, and graphics saved to an external hard drive.
   3. Operation and Maintenance Manuals: Factory operating and maintenance manuals with any customization required.
   4. Test Procedures and Reports: The test implementation shall be recorded with a description of the test exercise script of events and documented as test procedures.

3.9 WARRANTY

A. The warranty shall cover all costs for parts, labor, associated travel, and expenses for one year from Substantial completion and acceptance by the Owner.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service promptly after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday through Friday and 48 hours on Saturday and Sunday.

C. This warranty shall apply equally to both hardware and software.

D. All controllers shall be provided with a minimum warranty period of 3 years.

3.10 TRAINING

A. Controls Contractor shall provide a minimum of 16 hours of training with course outline and materials for personnel designated by the owner.

B. If desired manufacturer provided training on the use and operation of all products provided within these specifications shall be available for purchase and attendance by the Owner or his designated agent. A list of training courses with detailed course outline and duration with the associated cost shall be provided as part of the controls submittals.

3.11 BALANCING AND COMMISSIONING

A. Controls Contractor shall provide a minimum of 16 hours of commissioning assistance with a commissioning agent and 16 hours of balancing assistance with a balancing agent. Balancing and commissioning agents shall NOT be provided by Controls contractor – controls contractor is responsible for assistance only.

B. Controls Contractor shall provide and instruct balancing agent on use of commissioning mobile applications.

C. Providing commissioning data sheets prior to acceptance testing.

END OF SECTION

SECTION 25 11 00 ELECTRICAL CONTROLS AND INTERLOCKS

PART 1 - GENERAL

1.1 Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

1.2 RELATED WORK IN OTHER SECTIONS

26 05 00	GENERAL ELECTRICAL PROVISIONS
26 05 19	LOW VOLTAGE CONDUCTORS
26 05 26	GROUNDING
26 05 33	RACEWAYS, BOXES AND FITTINGS
26 27 26	WIRING DEVICES AND PLATES
26 29 00	MOTOR STARTERS

1.3 DESCRIPTION OF WORK

A. All disconnect means, motor controllers, electrical controls, protective, and signal devices for equipment furnished under Division 25 of these specifications will be installed and connected as scheduled herein or as otherwise noted on the drawings.

B. Electrical items not shown on the electrical drawings, but which are required for equipment furnished under Division 25 of this specification shall be furnished under this section of the specifications and shall be installed and electrically connected in conformance with Division 26 Specifications.

1.4 SUBMITTALS

A. Submittal data for each individual electrically controlled item of equipment or device furnished under this Division of these specifications shall include complete electrical wiring diagrams, and elementary control diagrams (ladder form) showing all internal and external wiring connections and services. The submittal data shall itemize all electrical characteristics that are of a special nature or critical to the electrical installation or control system. Such equipment and devices will not be considered for approval until these requirements are met. These submittals shall form a part Section 25 05 00 requirements and shall be properly coordinated by the Contractor.

B. As soon as possible after contract notice to proceed, one print of the ladder diagrams shall be submitted by the contractor showing all necessary wiring for the mechanical equipment and devices proposed for installation. This print shall be reviewed and approved by the contractor, and then submitted to the Architect/Engineer for approval. The print shall indicate all components which shall be wired to the control/power circuits by the contractor, with all terminals for external connections of the components identified and labeled to correspond to the manufacturer's designations. Internal or factory installed wiring of package-type components need not be shown. Control diagrams shall show all internal and external wiring connection and shall clearly indicate field wiring furnished and installed under Division 25, differentiated from field wiring furnished and installed under Division 26.

C. Revised Drawings: After the Architect/Engineer has approved the marked copy of the control diagrams submitted in accordance with Paragraph B above, the Contractor shall issue prints to all involved parties. The control diagrams shall be certified in writing as being acceptable to the contractor. The approved drawings will then be included in the control submittal and the Operating and Maintenance Manual.

1.5 INSTALLATION

A. No control work shall be performed until control submittal has been approved by the Architect/Engineer.

1.6 CHANGES DURING CONSTRUCTION

A. The complete responsibility and costs for revisions during construction to the approved control diagrams, and the resultant changes to the installation requirements, not covered by contract change order, shall be assigned to the contractor requesting such revisions.

PART 2 - PRODUCTS

2.1 CONTROL AND INTERPOSING RELAYS

A. Relays other than those on I/O cards shall be general purpose, enclosed plug-in type with 8 pin octal plug and protected by a heat and shock resistant dust cover. Relays shall be of the Neon or LED indicator type.

B. Relay contact configuration and ratings shall be for rated load voltage and exceed load current rating by no less than fifty percent. Minimum contact rating shall be 10 amps at 120 volts AC.

2.2 TERMINAL STRIPS

A. Terminal strips shall be of the molded nylon or polypropylene barrier type, individual plug-in mounted on a mounting channel. Terminal connections shall be rated 300-volt, 40 amp and shall be of the tubular clamp type for use with bare wire ends, or of the strap screw type for use with crimp spade lug prepared wire ends. Terminal strips shall provide for removable marking strips or have prepainted matte finish marking surfaces. Buchanan 600 series or approved substitute.

PART 3 - EXECUTION

3.1 RELAYS

A. All remote field devices shall be controlled through the use of an interposing relay. In no case shall a contactor or motor starter be directly controlled from a solid-state device output or relay contact of a rating less than that stated above.

3.2 COMPONENT IDENTIFICATION

A. All individual components (relays, timers, terminal strips, etc.) shall be clearly marked with the identification nomenclature shown on the manufacturer's shop drawings. Identification shall be by the use of press-type tape strip (kroy) covered with Scotch 600 clear tape or approved substitute method.

3.3 CONTROL WIRING INSTALLATION

A. The installation and wiring of all electrical equipment installed under this contract shall meet all Electrical Division specifications. Special attention is called to the following:

1. All wiring to be in conduit.
2. All control wiring to be color-coded throughout. Conductor color shall be consistent for the entire length of circuit.
3. All splices shall be made in junction boxes on terminal strips.
4. All control wiring to terminate on marked terminal strips and shall be marked at all terminal points. Both ends of each wire shall be marked with a designation shown on the manufacturer's shop drawings, using interlocking chevron shaped snap-on plastic markers, hot-marked shrinkable tubing, hot stamping of the wire, or clear shrink-on tubing securing adhesive labels. Markers which depend solely on adhesive are not acceptable.

END OF SECTION

SECTION 25 30 00 CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install a control system, complete in all respects to provide the Sequence of Control shown on the drawings.

B. All disconnect means, motor controllers, and all protective and signal devices for all electrical equipment provided under all Electrical Divisions will be furnished, installed, and connected under all Electrical Divisions with the following exceptions:
   1. All controls wiring and conduit for HVAC equipment is the complete responsibility of all Mechanical Divisions. Electrical connections, relays, interlocks, etc. not shown on the electrical drawings, but which are required for equipment furnished under all Mechanical Divisions shall be installed and electrically connected by all Mechanical Divisions in conformance with all Electrical Division Specifications.
   2. All disconnect means, motor controllers, and all protective and signal devices furnished with, mounted on, and connected integral with equipment furnished under other divisions.
   3. All disconnect means, motor controllers, electrical controls, protective, and signal devices for equipment furnished under all Mechanical Divisions of these specifications will be installed and connected as scheduled herein or as otherwise noted on the drawings.

C. The mechanical trade is entirely responsible for furnishing, installing, wiring, connecting, and placing the control systems in operation. Electrical work required will be the final responsibility of the Mechanical Contractor either by his own electricians or by his subcontract with an Electrical Contractor.

1.3 RELATED WORK IN OTHER SECTIONS

23 05 00	GENERAL HEATING, VENTILATING, AND AIR CONDITIONING REQUIREMENTS
23 05 93	BALANCING OF MECHANICAL SYSTEMS
25 00 00	INTEGRATED AUTOMATION INDEX
25 05 00	GENERAL INTEGRATED AUTOMATION REQUIREMENTS
25 11 00	ELECTRICAL CONTROLS AND INTERLOCKS
25 09 00	MECHANICAL SYSTEM INSTRUMENTATION AND CONTROL
26 05 00	GENERAL ELECTRICAL PROVISIONS
26 05 19	LOW VOLTAGE CONDUCTORS
26 05 26	GROUNDING
26 05 33	RACEWAYS, BOXES AND FITTINGS
26 27 26	WIRING DEVICES AND PLATES
26 29 00	MOTOR STARTERS

1.4 GENERAL REQUIREMENTS

A. The control system shall be furnished complete for the heating and air conditioning systems in accordance with Section 25 09 00. The temperature control company shall have a permanent, fully staffed, well-established, local office and service organization. A complete stock of all repair and replacement parts for all items furnished under this contract shall be carried in stock at the local office at all times.

B. Submittals: Shall include plan size drawings, with individual literature on each item, showing control sequences, complete electrical ladder diagrams and all control components and their wiring requirements. The Contractor shall be responsible to see that all systems are properly coordinated.

C. Operation and Maintenance Manuals: As soon as possible after Award of Contract, the Contractor shall prepare an Operation and Maintenance (O & M) Manual and submit it to the Engineer for review and approval. The control system testing and training specified hereafter shall not be conducted until the O & M Manual has been approved. See Specification Section 25 09 00 – MECHANICAL SYSTEM INSTRUMENTATION AND CONTROL. The Manual shall contain, as a minimum:
   1. Approved control diagrams.

2. Equipment and device catalog cuts identifying each control device with a unique number or symbol coordinated with the control diagram symbols.
3. A Sequence of Control for each system's control diagram identifying the function and physical location of each adjustable control device, written in language understandable to personnel not specifically trained in HVAC control systems.
4. A Troubleshooting section for each control system indicating what tests and/or adjustments can be made to identify and/or correct common problems with control systems of the type installed. This description should address procedures to determine the cause of high or low space temperature and/or humidity in a typical room served by each air handling system. The description should be adequate to lead untrained persons to conclude, at minimum, whether the unit is receiving adequate primary cooling or heating, whether mixed air and supply air temperatures are reasonable and whether field adjustments or technical service is required to solve the problem. This troubleshooting section shall be bound in a separate section of O & M Manual and shall clearly refer to control device symbols shown on the Control Diagram drawings.

1.5 SPECIAL REQUIREMENTS

A. The controls trade shall check and adjust his control system completely, four (4) times during the warranty period. The fourth (4) check to be made during the final thirty days of the warranty period.

B. The controls trade will furnish the Owner with an accurate, up-to-date wiring diagram of all electrical and electronic equipment installed under this contract.

C. The Contractor shall furnish a complete set of parts lists, operating instructions, and maintenance literature, in duplicate, for proper maintenance of all control equipment.

D. Steel lockable covers shall be provided for all space thermostats where shown on the drawings and where the space thermostat could be damaged.

PART 2 - PRODUCTS

2.1 CONTROL AND INTERPOSING RELAYS

A. Relays other than those on I/O cards shall be general purpose, enclosed plug-in type with 8 pin octal plug and protected by a heat and shock resistant dust cover. Relays shall be of the Neon or LED indicator type.

B. Relay contact configuration and ratings shall be for rated load voltage and exceed load current rating by no less than fifty percent. Minimum contact rating shall be 10 amps at 120 volts AC.

2.2 TERMINAL STRIPS

A. Terminal strips shall be individual plug-in type on a mounting channel. Terminal connections shall be rated 300-volt, 40 amp and shall be of the tubular clamp type for use with bare wire ends, or of the strap screw type for use with crimp spade lug prepared wire ends. Buchanan 600 series or approved substitute.

2.3 AUTOMATIC DAMPERS

A. All automatic dampers shall be furnished by the controls trade and shall be constructed of galvanized sheet steel with bushings made of oil impregnated sintered bronze to give constant lubrication. Each damper section shall have positive closing neoprene blade and edge seals. Outside air, return air and relief dampers shall have blades designed so that the blades are interconnected to give parallel movement. Each modulating damper shall provide a near linear relationship between damper opening and airflow. All volume dampers shall have opposed blades, which will produce equal pressure drop flow characteristics. Blade width shall not exceed 6 inches.

2.4 AUTOMATIC CONTROL VALVES - ELECTRIC

A. The controls trade shall provide all automatic control valves and shall be made by the control manufacturer. All electric control valves 2" and smaller in size shall be brass body and trim, 2-1/2" and larger shall be iron body with brass or stainless steel trim. Valves shall be provided with renewable type seats and adjustable springs. Valves shall be designed to pass the quantity of water and with a maximum pressure loss not to exceed 10 ft. Valves shall be provided with "V" port or throttling type seat. Valves 2" or smaller shall be screwed. Valves 2-1/2" and larger shall be flanged. All sequencing valves shall have positive positioners.

2.5 DAMPER MOTORS - ELECTRIC

A. The damper motor shall be electro-hydraulic type capable of providing full proportional control of dampers. The actuator shall be compatible with any low voltage controller or auxiliary device. One motor shall be provided per damper section.

2.6 CONTROL PANELS

A. An enclosed control panel or panels with hinged door and locking device shall be installed where shown on the drawings. Panel layout shall be as shown. Thermometers switches and pilot lights will be flush mounted on the hinged door. Hard tubing shall be brought into the panel. Tubing within the panel may be plastic neatly bundled and tagged. All indicators and controllers will have descriptive bakelite tags.

2.7 FILTER GAUGES

A. Shall be furnished and installed in each filter bank located in the Mechanical Room and at each rooftop air handling unit. Gauges shall be Dwyer Magnahelic with static pressure tips and interconnecting tubing. Range shall be approximately 1-1/2 times the nominal filter change out pressure differential. Each rooftop filter bank shall also have a differential pressure switch with indicator lamp located on a control panel in the Mechanical Room to indicate filter replacement pressure differential has been exceeded.

2.8 SMOKE AND FIRE DETECTORS

A. Smoke detectors shall be furnished and installed in each air handling unit or system and detectors shall be furnished by the Division 26 Contractor, installed by the Division 25 Contractor, connected, and tested by the Division 26 Contractor.

2.9 SEQUENCE OF OPERATION

A. The operation of the control system shall be as indicated on the drawings and control diagrams. The sequence shall be rewritten and shown on the control submittal drawing diagramming that system. The sequence on the submittal drawing shall identify control devices by number and physical location coordinated with the submittal drawing device numbers.

PART 3 - EXECUTION

3.1 RELAYS

A. All remote field devices shall be controlled through the use of an interposing relay.

3.2 INSTALLATION

A. No control work shall be performed until the control system shop drawings have been approved by the Engineer and returned to the contractor.

3.3 CONTROL WIRING

A. The installation and wiring of all electrical equipment installed under this contract shall meet all Division 16 specifications. Special attention is called to the following:
   1. All wiring to be in conduit.
   2. All control wiring to be color-coded throughout. Conductor color shall be consistent for the entire length of circuit.
   3. All splices shall be made in junction boxes on terminal strips.
   4. All control wiring to terminate on marked terminal strips and shall be marked at all terminal points. Both ends of each wire shall be marked with a designation shown on the manufacturer's shop drawings, using interlocking chevron shaped snap-on plastic markers, hot-marked shrinkable tubing, hot stamping of the wire, or clear shrink-on tubing securing adhesive labels. Markers which depend solely on adhesive are not acceptable.

B. Terminal strips shall be used in all boxes and cabinets where more than six control wires are terminated, spliced or both.

C. All control wiring shall be color coded and marked in each box, at each termination with Brady wrap around labels or suitable tags approved by the Architect. The schematic control diagrams shown on the contract drawings are for the convenience of the contractor and may not be complete in all details of control wiring for the equipment purchased for installation.

3.4 SYSTEM TESTING

A. The integrity and accuracy of each function and control point shall be demonstrated to the satisfaction of the Architect/Engineer during the test period. At the termination of the testing period the Contractor shall spend one working day instructing the Owner or his designated personnel in the control system operation. A complete operating booklet shall be provided and used during the training period.

B. Upon completion of the installation, the Contractor or his authorized representative shall be sent to the installation to certify that all necessary electrical tests and control adjustments have been completed. He shall then file a letter of Certification indicating that the system functions and conforms to the intent of these specifications.

END OF SECTION

SECTION 25 60 00 MECHANICAL AND ELECTRICAL COORDINATION SCHEDULE

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

B. It is the responsibility of the Contractor to carefully coordinate all trades to provide a complete and operational system that conforms to the contract documents.

1.2 DEFINITIONS

A. “Furnished by” shall mean that the materials, equipment, wiring, etc. shall be provided to the project by the noted contractor unless specifically noted otherwise in the contract documents.

B. “Install by” shall mean that the materials, equipment, wiring, labor, etc. shall be installed (mounted in field) at coordinated locations for complete system and shall be completed by the noted contractor unless specifically noted otherwise in the contract documents.

C. “Control wiring” shall mean that the controls wiring including all supports connections, etc. shall be installed complete by Contractor noted unless specifically noted otherwise in the contract documents.

D. “Power wiring” shall mean that the power wiring including all supports connections, etc. shall be installed complete by the Contractor noted unless specifically noted otherwise in the contract documents.

E. “Connected by” shall mean that all required materials and labor shall be provided to and for the complete installation of all devices and equipment and shall be completed by the noted contractor unless specifically noted otherwise on the contract documents.

1.3 SCOPE: Make all connections to motors and controls for equipment furnished and/or installed under Mechanical and Electrical Specifications according to the following schedule unless otherwise noted on the contract documents:

Item	**Furnished By**	**Installed By**	**Control Wiring By**	**Power Wiring By**	**Connected By**
Fire/Smoke Dampers	Div. 23	Div. 23			
Fire/Smoke Dampers Linkages	Div. 23	Div. 23			
Fire/Smoke Dampers Actuators/Smoke Detectors	Div. 23	Div. 23	Div. 28 (d)	Div. 28 (e)	Div. 28 (d)
Fire Alarm Panel and Interfacing with A/C Systems	Div. 28 (d)	Div. 28 (d)	Div. 28 (d)	Div. 28 (d)	Div. 28 (d)
Hydronic Valves	Div. 25	Div. 25			
Hydronic Valves Actuators	Div. 25	Div. 25	Div. 25	Div. 26(e)	Div. 25
Flow Control Regulators	Div. 25	Div. 25	Div. 25	Div. 26(e)	Div. 25
Duct Smoke Detectors	Div. 25	Div. 25	Div. 28 (d)	Div. 26 (d)	Div. 28 (d)
Volume Control Dampers	Div. 23	Div. 23			
Volume Control Dampers Linkages	Div. 23	Div. 23			
Volume Control Dampers Actuators	Div. 23	Div. 23	Div. 23		Div. 23
120V Thermostat Backboxes & Wall Conduit	Div. 26	Div. 26			
DDC Electronic Thermostats	Div. 25	Div. 25	Div. 25		Div. 25

DDC Terminal Controls	Div. 25	Div. 25	Div. 25	Div. 26 (b)	Div. 25
DDC Zone Control Panels	Div. 25	Div. 25	Div. 25	Div. 26 (b)	Div. 25
DDC Backboxes and Cabinets	Div. 25	Div. 16			
Non-DDC Control Relays	Div. 25	Div. 25	Div. 26	Div. 25	Div. 25
Non-DDC Thermostats, Time	Div. 25	Div. 25	Div. 26	Div. 25	Div. 25
Non-DDC Control Transformers	Div. 25	Div. 25	Div. 25	Div. 26 (e)	Div. 25
HVAC Instrumentation (electronic temperature sensors, etc.)	Div. 25	Div. 25	Div. 25	Div. 26 (e)	Div. 25
Equipment Motors	Div. 23	Div. 23	Div. 26	Div. 26	Div. 26
Motor Control Centers with Starters, Overload Heaters, H-O-A Switches, Pilot Lights, Push Buttons, etc.	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Motor Starters & Overload Heaters Outside Motor Control Centers	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Fused & Unfused Disconnect Switches Thermal Overload & Heaters	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Manual Operating & Multispeed Switches (Low Voltage – Less than Line Voltage	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Pushbutton Stations & Pilot Lights	Div. 26	Div. 26	Div. 25	Div. 26	Div. 26
Fire Protection Sprinkler System Control Supervisory Panels and Devices O.S.0.&Y. Switch, Flow Switch	Div. 21	Div. 21	Div. 28 (d)	Div. 26	Div. 28 (d)
Heat Taping for Mechanical Systems	Div. 23	Div. 23	Div. 23	Div. 26 (e)	Div. 26 (e)
Variable Frequency Drives	Div. 23	Div. 26	Div. 23	Div. 26	Div. 26
Heat Tape for Roof drains or Gutters	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26

Table Notes:

a. Unless specified to be furnished under Division 25 by the equipment supplier.
b. A dedicated isolated power circuit to Direct Digital Controls (DDC) Central Control Station shall be furnished and installed under Division 26.
c. Performed by the Fire Alarm Sub-Contractor Division 28
d. 120V connections by Div. 26

1.4 SUBSTITUTIONS: If the substitution of equipment, devices, or systems furnished under this Division result in changes to the Contract Drawings, Specifications and/or changes to the installation requirements, the complete responsibility and costs shall be assigned to the section of these Specifications under which the equipment is furnished with no additional costs to the Owner.

1.5 SUBMITTALS: In conjunction with the temperature control, Fire Extinguishing System, and DDC submittals, complete submittal data for each individual Electrically operated or Electrically controlled item of equipment or device furnished under this Division of these Specifications shall include Electrical wiring diagrams and elementary control diagrams (ladder form) showing all internal and external wiring connections and services and shall clearly indicate field wiring furnished and installed under Division 25, differentiated from field wiring furnished and installed under Division 26. The submittal data shall itemize all Electrical characteristics that are of a special nature or critical to the Electrical installation or control system. Such equipment and devices will not be considered for approval until these requirements are met. All submittal data shall be reviewed and approved by the General Contractor, Mechanical, Electrical and Controls Sub-Contractors prior to submission of the complete Temperature Control, Fire Extinguishing System and DDC submittal to the Architect. The submittals shall indicate all components that are to be wired into the control power circuit by the Electrical Sub-Contractor, with all terminals for external connections of the components identified and labeled to correspond to the manufacturer's designations. Internal or factory installed wiring of package-type components need not be shown. The Shop

Drawings for the system to be installed by the Temperature Controls, Fire Extinguishing System and DDC Sub-Contractors shall be prepared as complete submittals including all wiring requirements as described herein. Color coding designations shall be indicated for the control power circuit wiring.

PART 2 - PRODUCTS

2.1 REQUIREMENTS: The materials, equipment, and devices related to the Electrical System controls are specified under other sections of these Specifications.

PART 3 – EXECUTION

3.1 CHANGES DURING CONSTRUCTION

A. The complete responsibility and costs for revision during construction arising as a result of equipment substitutions, and any resultant changes to the installation requirements, shall be assigned to the respective section of these Specifications, under which the equipment is furnished at no additional costs to the Owner.

B. In the event of conflict in the delineation of responsibilities for the furnishing and installation of items of Mechanical equipment and the associated control and interlock wiring between Division 26, Division 25 shall provide all required material, labor, etc., to complete the work as shown in the contract documents.

3.2 INSTALLATION: No control work shall be performed until the reviewed and marked submittal data have been reissued to the Contractor, unless written permission is obtained from the Architect.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 00 00 ELECTRICAL INDEX

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Electrical Work, as indicated on the Drawings and specified herein. Electrical work indicated on the Drawings and/or specifications covering other trades shall conform to Division 26 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Electrical systems, shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for electrical service and control connections to all the various items of equipment requiring electric or wiring service throughout the project shown on the Contract Drawings (even if not shown on the Electrical Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 ELECTRICAL DIVISION INDEX

26 05 00	GENERAL ELECTRICAL PROVISIONS
26 05 19	LOW VOLTAGE CONDUCTORS
26 05 26	GROUNDING
26 05 33	RACEWAYS, BOXES, AND FITTINGS
26 05 36	CABLE TRAY
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 05 73	SHORT-CIRCUIT/ COORDINATION STUDY/ ARCH FLASH RISK ASSESSMENT
26 08 00	COMMISSIONING OF ELECTRICAL SYSTEMS
26 09 33	DIMMING SYSTEM
26 22 00	LOW VOLTAGE TRANSFORMERS
26 24 13	SWITCHBOARDS
26 24 16	PANELBOARDS
26 27 16	CABINETS
26 27 26	WIRING DEVICES AND PLATES
26 28 00	MOTOR AND CIRCUIT DISCONNECTS
26 28 13	FUSES
26 43 00	SURGE SUPPRESSION PROTECTION DEVICES
26 51 19	LED INTERIOR LIGHTING
26 60 00	MECHANICAL AND ELECTRICAL COORDINATION SCHEDULE

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 05 00 GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

B. The documents form part of the Specifications to the extent stated. Where differences exist between codes, the most stringent shall apply.

1.2 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment, and workmanship shall conform to the applicable provisions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC), Occupational Safety and Health Act (OSHA) all local, state, and national codes, ordinances and regulations governing the particular class of work involved and the terms and conditions of the electrical utility and other authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations, and authorities shall be made by the Contractor without additional charge to the Owner. The Contractor shall secure all permits and licenses required for their work and shall pay all fees in connection with such permits and licenses.

B. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved; and, on completion of the work, the Contractor shall obtain and deliver to the Owner, final certificates of acceptance. The Contractor shall furnish copies of each certificate to the Architect/Engineer.

C. Underwriter's Laboratories (UL): All materials, appliances, equipment, or devices shall conform to the applicable standards of Underwriter's Laboratories, Inc. where such standards have been established.

D. Standards: The current edition of the following specifications and standards shall form a part of these specifications:
1. National Fire Protection Association Standards
2. National Electrical Code, NFPA 70 (NEC)
3. Life Safety Code, NFPA 101
4. NFPA 72
5. Occupational Safety and Health Act (OSHA)
6. National Electrical Safety Code (NESC)
7. Underwriter's Laboratories, Inc. (Standards)
8. American National Standards Institute (ANSI)
9. American Society of Testing and Materials (ASTM)
10. Institute of Electrical and Electronic Engineers (IEEE)
11. Insulated Cable Engineer's Association (ICEA)
12. National Electrical Manufacturer's Association (NEMA)
13. Americans with disabilities Act Accessibility Guidelines (ADA)

1.3 DRAWINGS

A. The electrical drawings show the general arrangement of all conduit, outlets, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. The architectural and structural drawings shall be considered as a part of the work insofar as these drawings furnish the Contractor with information relating to the design and construction of the building. Architectural drawings shall take precedence over electrical drawings. Because of the small scale of the electrical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange their work accordingly, providing such fittings, elbow, pullboxes, and accessories as may be required to meet such conditions.

B. The Contractor shall verify the dimensions governing the electrical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings.

C. Drawings and specifications shall be considered as complementary. Work or materials called for by one and not mentioned in other shall be provided as though treated by both.

D. In the case of conflict between drawings and specifications, the greater or more restrictive requirement shall apply.

E. Any question as to the intent of the drawings or specifications shall be referred to the Architect/Engineer, whose decision shall be final and conclusive.

F. Should the Contractor observe any conflict or variation in the plans and specifications, they shall notify the Architect/Engineer in writing no later than seven (7) days prior to date of bid opening. Failure to clarify such variations will result in the Contractor bearing all costs arising from electrical work necessary to resolve the conflict or variation.

1.4 SERVICES

A. General: Requirements of the serving power and telephone utilities and availability of services have been determined as accurately as possible. The Contractor shall verify availability of services and determine actual details pertaining to the exact locations and requirements of utilities before submitting bid. No consideration for extra cost will be given resulting from failure to comply with these requirements by the Contractor. Contractor shall immediately notify the serving utilities that they has the job, and also furnish information as to the total lighting and power loads for the job. They shall also furnish, at the same time, information as to the established completion date of the job.

B. Telephone: Contractor shall immediately notify the serving utility of the estimated date when service will be desired.

1.5 AS-BUILT DRAWINGS

A. During progress of the work, the contractor shall maintain an accurate record of the installation of the system, locating each outlet, and note all circuiting deviations from the contract drawings. Upon completion of the installation, the contractor shall transfer all record data to a single neat and legible set of blue line prints of the original drawings.

1.6 OPERATING INSTRUCTIONS AND MANUALS

A. Instructions: Without additional charge to the Owner, furnish competent instruction to the Owner in the care, adjustment, and operation of all parts of the electrical equipment and systems.

B. Manuals: Upon completion of the work, prepare and deliver to the Owner two (2) sets of complete operating and maintenance manuals for the systems and major equipment installed, suitably bound in book form and must be originals. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data.

C. Other: The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment.

1.7 SITE VISIT

A. The Contractor shall visit the site prior to bidding and satisfy themself as to the conditions under which the systems are to be installed. No subsequent allowance shall be made on their behalf for failure to make such a visit.

1.8 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions covering the work. No extra compensation shall be claimed or allowed due to difference between actual dimensions and those indicated on the drawings. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting the work.

1.9 PERFORMANCE TESTS

A. Thoroughly test all fixtures, batteries, services, and all circuits for proper operating condition, required durations and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances and devices shall be operated under load conditions.

B. After the interior wiring system installation is complete and at such time as the Architect/Engineer may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices, and equipment after installation, to assure that all material continues to possess all the original characteristics as required by governing codes and standards listed in these specifications.

C. After occupancy of the building has taken place and nominal building power loads established, make voltage readings at all panelboards. Based on these readings, make final adjustments of taps on all transformers in the building as directed.

D. Perform such other tests as required by other sections of these specifications or as requested to prove acceptability.

E. Furnish all instruments and labor for testing.

1.10 REMODELING WORK

A. Where remodeling work is indicated, the Contractor shall be responsible for all electrical work associated with changes in, or removals of existing walls, ceilings, or floors. This work shall include rerouting of conduits, relocation of fixtures, devices, and conduits as well as provision for circuit continuity for circuits in remodeled areas. The cost of all of this work shall be included in the Contractor’s price with no additional compensation allowed for failure to include this work.

1.11 MISCELLANEOUS ITEMS

A. Miscellaneous items not covered in these specifications shall be as indicated on the drawings, installed, and connected in the proper manner and as recommended by the manufacturer.

1.12 GUARANTEE

A. All equipment and workmanship to be furnished under this contract shall be guaranteed for a period of one year from the date of final acceptance thereof against defective materials, design, and workmanship. Upon receipt of notice from the Owner of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the Contractor. The labor incident to the installation of these replacements shall be furnished by the Contractor.

1.13 STANDARDS OF MATERIAL AND WORKMANSHIP

A. All material shall be new and shall bear the label of the Underwriter's Laboratories, Inc., or be listed under re-examination service. All material shall be of the best grade and latest pattern of manufacture as specified. All work shall be performed in a neat, workmanlike manner and shall present a neat mechanical appearance when completed.

PART 2 - PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

A. The electrical requirements for equipment specified or indicated on the drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the electrical drawings, the Contractor shall make all adjustments to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective section of this specification under which the equipment is furnished.

2.2 MATERIALS

A. When the product of a specific manufacturer is indicated on the drawings or specified herein by catalog number or trade name, it has been done for convenience in fixing the standard for workmanship, finish, design, and the guaranteed performance. Any material, apparatus, or appliance which the Contractor desires to substitute for those mentioned herein shall also conform to these standards or exceed them and shall follow the procedure as outlined under substitutions and specified herein.

B. All similar materials and equipment shall be the product of the same manufacturer.

C. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the contract requirements and meets the approval of the Architect/Engineer.

D. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.

E. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the project site.

2.3 NAMEPLATES

A. All items of mechanical and electrical equipment shall be identified by the attachment of engraved nameplates, constructed from laminated phenolic plastic, at least 1/16" thick, three-ply, black surface and white core. Plates shall be attached using stainless plate screws unless indicated otherwise. Nomenclature on the label shall include the name of the item and feeder circuit number. Equipment to be labeled shall include, but not be limited to, the following:
1. Air Conditioning Control
2. Contactors
3. Panels and Switches
4. Time Switches
5. Relays
6. Disconnect Switches
7. Starters
8. Transformers
9. Miscellaneous
10. Similar and/or related items

2.4 IDENTIFICATION AND SIGNS

A. Label each individual motor controller, disconnect switch, transformer and remote-control device to identify each item and its respective service.

B. Provide nameplates with engraved lettering not less than 3/8 inch high where specified or noted. In general, use white core laminated plastic, attached with screws. Embossed plastic adhesive tape is not acceptable. Flush mounted devices may have identification engraved in the device plate.

C. Provide warning signs on all equipment or devices operating at 300 volts or more, reading “DANGER - 480 VOLTS” (insert respective voltage) etc., with white letters on red background of standard code size. Signs may be decals, stencils, or nameplates.

D. Identify panelboards and cabinets by nameplates with descriptions indicated on the drawings together with voltage and phase. Install on outside of hinged doors of panelboards and cabinets.

2.5 CHANGES

A. No changes shall be made in the electrical work as shown and herein specified, unless such changes are authorized in writing by the Architect/Engineer and such authorization shall contain a statement covering the amount of the charges involved in the change.

2.6 SUBSTITUTIONS

A. On all material, substitutions will be considered only if requested by letter from the Contractor to the Architect/Engineer. Letters must be in the engineer's office no later than 10 days prior to the bid date and shall be considered as authorized only upon written confirmation from the Architect/Engineer. Where materials are proposed to be substituted in lieu of the items specified, substitutions shall be equal in quality, workmanship, and design. The burden of proof of equality of materials shall be placed upon the Contractor. Samples of all materials proposed for substitution shall be submitted to the Architect/Engineer, when requested, for examination.

2.7 SHOP DRAWINGS

A. Shop drawings shall be furnished for all equipment and materials. They shall be furnished by the Contractor as required in the Submittal Section. Where equipment will be furnished "as specified," a statement to that

effect is sufficient. Where substitutions are proposed, complete data must be furnished showing performance, quality, and dimensions.

B. The Contractor shall submit to the Architect/Engineer for checking a complete descriptive and technical data list for all items of material furnished under this contract. Complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation shall be shown. Fixture submittals shall include scale drawings showing metal gauges and finish together with complete photometric distribution curves and coefficient of utilization tables. Glare factor curves shall also be submitted for each fixture. Failure to submit this information can be the basis for disapproval.

C. All descriptive and technical data and shop drawings shall bear signed certification that they have been carefully examined and found to be correct with respect to dimension, space available, non-interference with other trades and that the equipment complies with all the requirements of these specifications. Submittals that have not been checked for compliance will not be considered by the Engineer.

D. Only complete submittals will be considered, partial submittals will not be reviewed.

2.8 SUBMITTALS

A. Submittals shall be complete; bound booklets with an index of all items submitted including associated catalog/part numbers. The Contractor shall make submittals on all the following equipment (in addition to any special items indicated elsewhere in the plans or specifications):
1. Lighting Fixtures and Lighting Control(s)
2. Wiring devices
3. Conduit
4. Wire
5. Panelboards
6. Switchgear
7. Fuses
8. Metering equipment
9. Transformers
10. Starters
11. Contactors
12. Disconnect switches
13. Special Systems equipment (Fire Alarm, Intrusion Alarm, Sound, TV, Lightning Protection, etc.).
14. Dimensioned Electrical Room(s) and Data/IT Room(s) with complete layout of proposed equipment at scale with all clearance requirements identified to be in compliance with the NEC.

B. Electrical System Controls: Refer to Section 253000 for additional submittal requirements.

C. After receiving approval on the make and the type of materials, the Contractor shall order such materials in sufficient time to prevent any delay or changes on the job.

PART 3 - EXECUTION

3.1 GENERAL

A. Fabrication, erection, and installation of the complete electrical system(s) shall be done in a first-class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed, or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies the Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workmen.

3.2 EQUIPMENT

A. Equipment and materials furnished by the Contractor shall fit the spaces allocated for them. Should the equipment which the Contractor proposes to install, require space conditions other than indicated on the drawings, it shall be the Contractor's responsibility to reconcile the available space with the equipment and make any changes required to accommodate the equipment. All required changes shall be made at the Contractor's expense.

B. All equipment, both the Contractor and Owner furnished, shall be installed in accordance with the manufacturer's recommendations.

3.3 COORDINATION

A. The Electrical Plans are diagrammatic, but shall be followed as closely as actual construction and the work of other trades will allow. Such minor changes as are necessary to make the electrical work conform to the work of other trades and to the building shall be made without cost to the Owner.

3.4 CIRCUITS AND FEEDERS

A. Circuits and feeders shall be as shown and no deviations from the indicated outlet-circuit grouping will be permitted, except by permission of the Architect/Engineer. Branch circuit numbers are mandatory and shall be changed only on written permission from the Architect/Engineer. Any changes in layout or circuit numbering shall be accurately recorded on the "As-Built" drawings.

3.5 CONDUITS

A. In all spaces, such as ceiling spaces and equipment rooms, all conduits shall be run to a continuous grade and square to the building.

B. The plans do not give exact details as to the elevations of conduits, exact locations, etc., and do not show all off-sets, bends, junction boxes and other installation details. The Contractor shall carefully lay out their work at the site to conform to details of installation.

3.6 LOCATION OF EQUIPMENT AND OUTLETS

A. The approximate locations of cabinets, panelboards, wiring gutters, switches, light outlets, power outlets, etc., are indicated on the drawings; however, they are not intended to give complete and exact information. Determine the exact location after thoroughly examining the general building plans and by actual measurements during construction, subject to the approval of the Architect/Engineer.

B. Verify with Architect/Engineer, prior to installation, all locations of conduit, boxes, etc. stubbed or in the floor.

3.7 PROTECTION OF MATERIALS AND EQUIPMENT

A. The Contractor shall be responsible for the protection of all materials and equipment under this section of the work whether incorporated into the building or not.

B. The Contractor shall provide protection for all work where necessary and will be responsible for all damage done to property during the construction. The above protection shall be maintained while the work is in progress. In no case shall dirt, grit, etc. be ground into the floor finish or coverings.

C. The Contractor shall provide space for storage of materials and equipment at ground level.

3.8 CUTTING AND REPAIRING

A. Cutting and repairing shall be the responsibility of the Contractor. Coordinate to prevent unnecessary cutting and repairing. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports.

B. When applicable, any and all repairs made to warrantable surfaces or systems shall be made in a fashion to preserve the warranty and meet the manufacturer’s recommendations.

3.9 EXCAVATION AND BACKFILLING

A. The Contractor shall do all necessary excavation and backfill for the installation of the systems as may be required. Curb cuts, asphalt, and concrete patching, etc., shall be part of the Contractor's responsibility. Prior to any required trenching, contractor shall have all utilities identified and will be done by hand within 36” of all existing utilities. Damage done to existing utilities will be repaired by the Contractor with no additional payment for the work. In addition to the above, trenches shall be backfilled with dirt, free from debris, rocks, and other foreign matter. Backfill shall be replaced in the trenches in 6" layers and each 6" layer shall be wetted down adequately and properly tamped. Remove surplus dirt and leave premises clean.

B. Perform excavation, backfilling and surface repairs required for work under this Division in accordance with OSHA and other requirements of the contract documents. In general, backfill and tamp with compaction at least equal to that of the surrounding area or as prescribed by structural engineer of record.

C. Contractor shall restore all existing and new surfaces to comply with ADA ordinances, the Contract documents, or existing surrounding conditions.

3.10 WARRANTY

A. Deliver originals of all guarantees and warranties on this portion of the work to Owner. Warrant all equipment, materials, and workmanship for one year minimum in accordance with the terms of this Contract or as required elsewhere in the contract documents.

3.11 PRODUCT HANDLING

A. Use all means necessary to protect electrical materials and equipment before, during and after installation and to protect the installed work of other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no extra cost to them.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 05 19 LOW VOLTAGE CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install all conductors as required for the complete installation and operation of all electrically serviced and/or operated equipment, devices, and systems throughout the project.

1.3 RELATED WORK IN OTHER SECTIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of Division 26 Sections apply to this Section when applicable.

PART 2 - PRODUCTS

2.1 WIRES AND CABLES (600 VOLTS)

A. Type: Conform to the applicable UL and ICEA Standards for the use intended. Copper conductors with 600-volt insulation unless otherwise specified or noted on the drawings. Stranded conductors for No. 6 and larger except where elsewhere specified or noted on the drawings.

B. Use of aluminum conductors will not be permitted unless explicitly illustrated otherwise, or prior approved.

C. Insulation: Type THWN, 75-degree C. insulation unless otherwise specified or noted on the drawings. 90 degrees C. minimum insulation within fixture wireways of fluorescent fixtures. Where 90-degree C. insulation is specified, the termination points for this conductor shall be rated for 90 degrees C.

D. Size: No. 12 minimum unless otherwise specified or noted on the drawings. In the case of "homeruns", no conductor smaller than #10 shall be used for runs over 100 feet in length on 120-volt circuits. Not less than NEC requirements for the system to be installed. If the equipment to be installed requires larger conductor and conduit sizes than indicated on the drawings, the required changes shall be made without additional charge. Remote control wires, other than Class 2 remote control and signal circuits, shall be no smaller than #14.

E. Color Coding: Phase, neutral and equipment ground conductors color-coded. Connect all conductors of the same color to the same phase conductor. Color coding shall be A-black, B-red, C-blue, N-white, for 250 volts or less. A-yellow, B-orange, C-brown, N-off white or grey, for 251-600 volts, with green for all equipment ground conductors. Conductors No. 12 and 10 shall be solid color compounded for the entire length. Conductor sizes larger than No. 10 may be color coded at each termination and in each box or enclosure with six inches of half-lapped 3/4-inch pressure sensitive, plastic tape of respective colors in lieu of solid color compound. The equipment grounding conductor shall be bonded to the outlet box grounding screw with taps to receptacles and equipment. Isolated ground conductors shall be green in color with a yellow trace.

2.2 CONTROL CONDUCTORS

A. Copper, minimum size No. 14 with 19/35 stranding, color coded filled cross linked polyethylene 75-degree C. 600-volt insulation and neoprene or equal outer jacket. Multi conductor control cables shall be provided where more than three control conductors are installed in the same conduit between common terminations. Provide two spare conductors minimum in each control cable.

2.3 DATA/COMMUNICATION AND ELECTRONIC CABLE

A. Refer to Division 27.

2.4 VERTICAL CABLE SUPPORTS

A. Split wedge type supports which clamp each individual conductor and tightens due to weight of the cable shall be used for cables without metallic sheath. Basket weave type supports shall be used for cables with metallic sheath.

2.5 CONNECTORS AND LUGS

A. For Copper Conductors No. 6 and Smaller: Compression or indent type connectors with integral or separate insulating caps.

B. For Copper Conductors Larger Than No. 6: Solderless, indent, hex screw, compression, or bolt type pressure connectors, properly taped or insulated.

2.6 TAPE

A. Plastic tape, 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D-568 Test Method B.

PART 3 - EXECUTION

3.1 CONDUIT SYSTEMS

A. A complete system of conductors shall be installed in the raceway systems. All conductors of all systems shall be installed in raceway or conduit unless explicitly illustrated otherwise or prior approved.

B. Lighting fixtures shall not be used as raceways for circuits other than parallel wiring of fixtures. Wiring in fixtures shall be rated for that purpose.

C. When leaving a metal raceway or conduit in a cabinet, box, switch, enclosure, control enclosure or any other like member, conductors shall be protected by means of insulated bushings or end fittings. These protectors shall be "O.Z." type or similar.

D. Parallel conductors may be provided when larger than #1/0 and all phased conductors are the same size, length, and type of insulation. Multiple runs are to be in separate conduits. Each conduit to include one set of phase conductors, neutral and grounding conductors.

E. No splices or taps shall be made in any conductors except in outlet boxes, pull boxes, junction boxes, panelboard boxes, manholes or splice boxes. All taps and splices shall be made with solderless connectors and insulated in such a manner that provides an effective insulation equal to that of the adjoining wire. Any splice or tap shall be made only on conductors which are a component part of a single circuit properly protected by approved methods.

F. Before any wire is pulled into any conduit, the conduit shall be thoroughly swabbed in such a manner as to remove all foreign material and to permit the wire itself to be pulled in a clean, dry conduit. The Contractor shall use only approved wire pulling lubricants for pulling any wire. All conductors shall be pulled into their respective conduits by hand, except where written permission of the Engineer is secured to the contrary.

3.2 WIRE AND CABLE TESTS (600 Volts)

A. Measure the insulating resistance of service entrance conductors, feeder circuit conductors and service ground. Measurements shall be taken between conductors and between conductors and ground. Resistance shall be 1,000,000 ohms or more when tested at 500 volts by megger without branch circuit loads. Tests and procedures shall meet the approval of the Architect/Engineer and shall be in accordance with the applicable IPCEA standards for the wires and cables to be installed. Furnish all instruments, equipment and personnel required for testing and conduct tests in the presence of the Architect/Engineer. Submit written reports of the tests and results when requested.

3.3 PULL WIRES

A. In each empty conduit, except underground conduits, install a No.14 galvanized steel pull wire or a plastic line having a tensile strength of not less than 200 pounds. In each empty underground conduit, install a No.

10 AWG bare, hard drawn copper or copper clad pull wire or a plastic line having a tensile strength of no less than 200 pounds.

3.4 IN RACEWAYS

A. Install conductors in rigid conduit, EMT or flexible metallic conduit, unless otherwise specified or noted on the drawings.

3.5 CABLE BENDS

A. Radius of bends not less than 10 times the outer diameter of the cable.

3.6 BUNDLING

A. In cabinets conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits.

3.7 CONDUCTOR PULL

A. Conductors shall not be pulled into conduits until after all plastering or concrete work is completed and all conduits in which moisture has collected have been swabbed out.

3.8 FEEDER IDENTIFICATION

A. Tag feeder circuits in each enclosure with wrap around circuit designation labels where more than one feeder passes through or terminates in the enclosure.

3.9 CONNECTORS AND LUGS

A. Install with manufacturer's recommended tools and with the type and quantity of deformations recommended by manufacturer.

B. Contractor shall review one-line and other Drawings to assure that proper lugs are provided in termination equipment such as switches, panels, switchboards, mechanical equipment, etc. Due to voltage drop conductor sizes and/or numbers may not be accommodated by the equipment affected. If manufacturer cannot provide the proper number and size of lugs within their equipment the Contractor shall provide enclosures and properly sized terminals to convert the oversized cable, number and size that is compatible to the equipment affected.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 05 26 GROUNDING

PART 1 - GENERAL

1.1 RELATED WORK IN OTHER SECTIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of Division 26 Sections apply to this Section when applicable.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials, equipment, and devices related to the grounding system are specified under other sections of these specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Install two separate grounding systems, a service grounding system, and an equipment grounding system. The service equipment, conduit systems, supports, cabinets, equipment, and neutral conductor shall be grounded in accordance with the minimum code requirements and as further indicated on the drawings or specified. Connect the two grounding systems together only at the main service equipment and at the secondary terminals of transformers creating separately derived distribution systems such as dry-type transformers.

3.2 SERVICE GROUNDING SYSTEM

A. General: The service grounding system is provided for the AC service neutral ground. Current return conductors, such as neutrals of the service entrance, feeder circuits and branch circuits, shall not be used for equipment grounding. Care must be exercised to ensure that neutral bars are not bonded to the enclosures of panelboards, etc., which are not part of the main service equipment. Except for separately derived systems, the neutral conductors shall be grounded only in the main service equipment.

B. Common Ground Point: Establish one common ground point in the main service equipment by interconnecting the insulated neutral bus (or bar), the uninsulated equipment ground bus (or bar), and service grounding electrode conductor.

C. Neutral Disconnecting Means: Install a neutral disconnecting means in the main service equipment for disconnecting and isolating the neutral bus from the common ground. The disconnecting means may be disconnecting links in the interconnection between the insulated neutral and uninsulated equipment ground.

D. Neutral Bars: Provide an insulated neutral bar, separate from the uninsulated equipment ground bar, in all panelboards, transformers, starters, disconnect switches, cabinets, etc. which have neutral connections.

3.3 EQUIPMENT GROUNDING SYSTEM

A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the drawings or specified. The equipment ground (green conductor) consists of metallic connections to ground of non-current carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current carrying parts of the system and to provide a low impedance path to ground for possible ground fault currents.

B. Common Ground Point: Establish one common ground point as specified elsewhere in this section of the specifications for interconnection of the equipment grounding system and the service grounding electrode conductor.

C. Service Equipment Enclosure: Bond the enclosure of the main service equipment to the uninsulated equipment ground bus (or bar) with a conductor or bar sized for 25% of the largest service overcurrent device.

D. Ground Bar: Provide an uninsulated equipment ground bar, separate from any insulated neutral bar, in all switchboards, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc. for grounding the enclosure and for connecting other equipment ground conductors. The ground bar shall be an integrally mounted and braced bus bar in switchboards or a separately mounted bar adequately braced or bolted to the enclosure of other types of equipment. The ground bar shall be adequately braced or bolted to the enclosure after thoroughly cleaning both surfaces to assure good contact. Provide solderless pressure connectors for all conductor terminations. Number and size of pressure connectors on equipment grounding bars as required for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three-phase spares and spaces.

E. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring only shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each nonmetallic conduit or duct except those used for telephone, sound, or low-voltage signals and in all flexible conduit that does not have a built-in ground conductor. Bond the conductor at both ends to the equipment grounding system.

F. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit with a three-phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits unless otherwise indicated. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders installed in more than one raceway each raceway shall have a green insulated equipment ground conductor.

G. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings.

H. Motors: Install a separate green insulated equipment grounding conductor from the equipment ground bar in the motor control center of separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor. Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.

3.4 SEPARATELY DERIVED SYSTEMS

A. Transformers creating separately derived distribution systems, such as dry-type transformers, shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground with separate grounding conductor extended to an approved ground electrode.

3.5 GROUNDING ELECTRODE SYSTEM

A. A minimum of two service ground electrodes shall be utilized. One shall be the main cold water metallic water piping system and the other shall be a made electrode consisting of not less than twenty feet of bare copper conductor encased along the bottom of a concrete foundation footing which is in direct contact with the earth. Make the connections to the cold water pipe inside the building at the point of entrance. Other grounding electrodes (building steel, ground counterpoise, etc.) shall be bonded to the grounding electrode system where utilized. The grounding electrode for separately derived systems shall be approved for the application.

3.6 GROUNDING CONDUCTORS

A. The grounding electrode conductors for the service grounding electrode system shall be insulated or bare copper, sized in accordance with NEC, including the conductor for the supplemental electrodes. The conductors shall be continuous without joint or splice and shall be installed in conduit with the conduit bonded to the conductor at each end. Install the conductor to permit the shortest and most direct path and terminate in the main service equipment on the common ground point. Equipment grounding conductors shall be green insulated conductors equivalent to the insulation on the associated phase conductor. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of

panelboards or transformers, the equipment grounding conductor shall be continuous without splices. Grounding conductors shall not be installed through metal-sheathed holes. All connections shall be available for inspection and maintenance.

3.7 GROUND CONNECTIONS

A. Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed apply a non-corrosive approved compound to cleaned surface and install lugs or clamps. Where galvanizing is removed from metal it shall be painted or touched up with "Galvanox", or equal.

B. All grounding connections to bare stranded wire, ground rods, etc. shall be BURNDY HY-GROUND™ or approved equivalent or approved exothermic connection method. All connectors shall meet the requirements of IEEE STD 837 (Latest Revision), “IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding”. All connectors must be listed by Underwriters Laboratories for direct burial in earth or embedment in concrete applications according to ANSI/UL-467 (latest revision), “Standard for Grounding and Bonding Equipment.” Connectors must be suitable for lightning protection applications. Listing to UL-96 “Lightning Protection Components” preferred on applicable items.

3.8 TESTS

A. Test the completed grounding system with a megger at the service ground bar and submit a written report to the Architect/Engineer for approval. The service shall not be energized if the test shows more than 5 ohms, unless approved by the Architect/Engineer.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 05 33 RACEWAYS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install complete conduit systems for the various electrical systems required for this project. Systems shall be complete with supports, mounting devices, pull boxes, etc., as required for installation of wiring systems and terminal devices.

1.3 RELATED WORK IN OTHER SECTIONS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of Division 26 Sections apply to this Section when applicable.

PART 2 - PRODUCTS

2.1 CONDUITS

A. Steel Conduit: Rigid, threaded, thick wall, hot dipped galvanized.

B. Electrical Metallic Tubing (EMT): Mild steel, zinc coated on the outside and either zinc coated or coated with an approved corrosion resistant coating on the inside. Maximum size 2-inch electrical trade size unless noted on the drawings or specifically approved.

C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion resistant coating on the inside.

D. Flexible Conduit: Commercial "Greenfield," galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.

E. Liquid Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid tight PVC outer jacket and a continuous copper bonding conductor wound spirally between the convolutions. Where a separate grounding conductor is installed in the conduit, bonding conductor in the convolutions may be omitted.

F. Plastic coated rigid steel conduit shall be hot dipped galvanized steel conduit with a coating of polyvinyl chloride, minimum 15 mills (0.015), on the exterior surfaces, shall have an approved corrosion resistant coat inside. To be Pittsburgh, J & L, Republic or approved equal.

G. Rigid Non-Metallic Conduit: Schedule 40, high impact PVC with 7,000 psi tensile strength at 73.4-degree F., 11,000 psi flexural strength, 8,600 psi compression strength, approved for 90-degree C. conductors. Carlon, triangle, or approved equal. PVC conduits shall include a ground wire sized as noted or as required by NEC (whichever is larger). No bends shall be made in PVC. Rigid galvanized steel conduit shall be utilized for all elbows, risers, and bends.

H. Aluminum Conduit: Shall not be used unless specifically indicated on the drawings for specialized purposes.

I. Conduit Size: Minimum conduit size, 1/2 inch except where specifically approved for equipment connections. Sizes not noted on drawings shall be as required by the NEC. All homeruns to panels shall be 3/4 inch minimum.

2.2 CONDUIT FITTINGS

A. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. EMT couplings and connectors either steel or malleable iron only, "Concrete Tight" or "Raintight" and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have

insulated throats. EMT fittings using set screws or indentations as a means of attachment on conduits 2” or larger are not permitted.

B. All conduits shall terminate in bushings or connectors which are insulated type, designed to prevent abrasion of wires without impairing the continuity of the conduit grounding system.

C. Rigid Steel Conduit, IMC and EMT Fittings: Iron or steel only.

D. Liquid Tight Flexible Conduit Fittings: With threaded grounding cone, a steel, nylon or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seat. Each connector shall provide a low resistance ground connection between the flexible conduit and the outlet box, conduit, or other equipment to which it is connected.

E. Rigid Aluminum Conduit Fittings: Malleable iron, steel, or aluminum alloy. Ferrous fittings zinc coated or cadmium plated. Aluminum alloy fittings shall conform with the characteristics defined by UL for aluminum rigid metallic conduit and shall not contain more than 0.04 percent copper.

F. Flexible Conduit Fittings (Commercial Greenfield): Either steel or malleable iron only, with insulated throats and shall be one of the following types:
   1. Wedge and screw type with angular wedge fitting between the convolutions of the conduit.
   2. Squeeze or clamp type with bearing surface contoured to wrap around the conduit and clamped by one or more screws.
   3. Steel, multiple point type, for threading into internal wall of the conduit convolutions.

G. Expansion Fittings: Each conduit that is buried in or rigidly secured to the building construction on opposite sides of a building expansion joint and each long run of exposed conduit that may be subject to excessive stresses shall be provided with an expansion fitting. Expansion fittings shall be hot dipped galvanized malleable iron with factory installed packing and a grounding ring.

H. Sealing Fittings: Threaded, zinc or cadmium plated, cast or malleable iron type for steel conduits and threaded cast aluminum type for aluminum conduits. Fittings used to prevent passage of water vapor shall be of the continuous drain type.

I. Fittings for PVC Coated Rigid Steel Conduit: Ells and couplings used with PVC coated rigid steel conduit shall have a factory applied coating of polyvinyl chloride, minimum 15 mills (0.015) on exterior surfaces and shall have a PVC sleeve extruded a minimum of 2" from one end of the fitting.

2.3 WIREWAYS

A. Square-D Company Square-Duct (or equal) "lay-in" type without knockouts with lengths and fittings hinged to provide an unobstructed wireway to "lay-in" conductors. Use standard lengths. Field cuts permitted where absolutely necessary. Rust inhibiting phosphatizing coating on sheet metal parts. Blue gray baked enamel finish. Hardware plated to prevent corrosion. Provide all accessories, including tee fittings, junction boxes, cross fittings, transposition section, gusset brackets, nipples, pull boxes, reducer fittings, wall flanges, panel or cabinet flanges, elbows, ceiling, and wall support brackets and supporting hardware, etc.

2.4 BUSSED GUTTER

A. Bussed gutter shall be amperage, voltage, and phase configuration as noted on the drawings, with a 50% ground bus. Provide lugs on bus bars as indicated on the drawings. All bus bars shall be copper. Use of aluminum bus bars will not be permitted.

2.5 OUTLET BOXES

A. Construction: Zinc coated or cadmium plated steel boxes of a class to satisfy the condition at each outlet except where unilet or condulet bodies are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang boxes, 4-inch octagon concrete rings and 4-inch octagon hung ceiling boxes with bars may be folded type. One piece deep drawn type for all other boxes.

B. Size: To accommodate the required number and sizes of conduits, wires, and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed

6 inches deep except where necessary to permit entrance of conduits into side of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.

C. Fixture Studs: 3/8-inch malleable iron fixture stud in outlet boxes for ceiling lighting fixtures and interior bracket lighting fixtures, other than lamp receptacles and drop cords.

D. Exposed: Screw joint type, with gasketed weatherproof covers in locations exposed to the weather. Shall be of the continuous drain type. Where required to be "Raintite."

E. Tile Boxes: Rectangular in shape with square corners and straight sides for receptacles and switches mounted in furniture cabinets or in glazed tile, concrete block, marble, brick, stone, or wood walls. Install without plaster rings.

F. Wall Mounted Switch, Receptacle and Signal Boxes: Unless otherwise noted or specified, not less than 4 inches square by 1-1/2 inches deep for single devices, 4-11/16 inches by 1-1/2 inches deep for two devices and multi gang boxes for more than two devices. Boxes for switches and receptacles on unfinished walls may be screw joint type with covers to fit the devices. Provide plaster rings, as required, to provide proper opening for device.

G. Wall Mounted Telephone Outlet Boxes: 4-11/16 inches square by 2-1/8 inches deep, unless otherwise noted on the drawings.

H. Light Fixture Boxes: 4-inch diameter by 1.5-inch-deep minimum for ceiling and interior bracket fixtures with concealed conduits. Plaster covers for bracket fixtures to have 3-inch diameter openings. Screw joint boxes with canopy seat for ceiling and interior bracket fixtures with exposed conduits.

I. Grounding Terminal: Provide a grounding terminal in each box with circuits serving motor driven equipment or receptacles for grounding to a green equipment ground conductor. Grounding terminal shall be green colored washer-in-head machine screw.

2.6 PULLBOXES

A. Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets for pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion resistant screw or bolt attachment.

2.7 FLOOR BOXES

A. Heavy duty, cast, adjustable type, suitable for the device or application indicated, unless noted otherwise or prior approved. Provide carpet flanges in carpet areas.

B. Fire-Rated Poke-Throughs (FRPT): Poke-Through, fire rated, style boxes shall be utilized for floor assemblies above grade meeting the floor assembly rating. Any penetrations shall be coordinated with the structural engineer of record.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

A. Conduit Systems: Conduit shall be provided for all wiring circuits. Material shall be exposed or concealed as required by the Drawings. Rigid Steel conduit, IMC, EMT or Rigid Non-Metallic conduit unless noted. Install rigid steel conduits for underground runs, when specifically noted on the drawings, runs in concrete, feeder circuits and where required by the NEC for mechanical protection, etc. Use flexible conduit only for equipment connections and then only to the extent of minimum lengths required for connections (Typically 1'-0", maximum length 4'-0"). Install flexible conduit connections at all resilient mounted equipment. Provide liquid tight flexible conduit in exterior, wet or damp locations and for connections to all motors, dry type transformers and wet pipe mechanical systems. Aluminum conduit may be used only if specifically called for. Conduit and tubing shall be kept at least 6 inches from parallel runs of hot water or steam pipes. PVC conduit may be used only for runs below grade or in slab. Concrete encasement is required under all paved areas. Rigid steel, galvanized elbows shall be used for all bends and risers. No PVC shall be extended above grade or slab. Ground wires, sized in accordance with NEC, shall be installed in all conduit runs, except where used for telephone conductors.

B. Conduit Installation: Install concealed conduit and EMT in as direct lines as possible. Install exposed conduits and EMT parallel to or at right angles to the lines of the building. Right angle bends in exposed conduit and EMT runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radii no less than those of standard elbows. Exposed conduits below the five (5) foot level shall be galvanized rigid conduit.

C. Concealed Conduits: Install conduit systems concealed where possible unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities and where specifically approved by the Engineer. No conduit shall be run on roof or exposed face of building unless specifically shown on plans or prior approved by all of the Owner/Architect/Engineer.

D. Conduit in Concrete: Conduits shall not be installed in floor slabs poured on grade. Conduits under slab shall be installed a minimum 6” below slab, covered with earth. PVC coated rigid steel conduit may be embedded in above grade concrete providing the outside diameter does not exceed 1/3 thickness of concrete slab, wall, or beam, is located entirely within the center third of the member and lateral spacing of conduit is not less than 3 diameters.

E. Conduit in Ground: PVC schedule 40 non-metallic conduit may be utilized for all underground runs unless noted otherwise on the drawings. Installation and use of PVC shall comply with NEC. All conduit sizes, shown on the plans, shall be increased to accommodate the installation of the equipment grounding conductor. All joints shall be made with solvent cement per manufacturer's recommendations and shall be watertight. PVS schedule 40 plastic conduit runs shall not be stubbed up above grade, and shall be converted to PVC schedule 80 or PVC Plastoid coated rigid steel conduit by installing a female adapter, 90 degree PVC coated rigid steel elbow and a PVC coated rigid steel nipple of length as required to stub conduit up. Plastic conduit shall be used for straight runs only. PVC coated rigid steel conduit shall be used for all bends, ells and offsets. Where rigid galvanized steel conduit is in contact with dirt, soil, fill or earth, conduits shall be field wrapped with one layer of 3M Scotch 50 plastic tape with a 50% overlap, including all joints or couplings, or shall be coated with a bonded, 20 mil minimum thickness PVC, permanently fused at the factory, or approved equal. An equipment grounding conductor, in accordance with NEC, shall be installed in all conduits. Minimum burial depth of conduits or ducts shall be as follows:

Power: Primary (above 600v.), 42" unless encased in concrete or specified otherwise by serving utility.
Secondary (below 600v.), 36" unless encased in concrete.
Telephone: 24" unless encased in concrete or specified otherwise by serving utility.

F. Conduit Bends: In any conduit or EMT run, the number of quarter bends or equivalent between termination’s at cabinets or boxes shall not exceed four bends. Bends in telephone and data conduits shall be long sweeping bends.

G. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.

H. Roof Penetrations: All roof penetrations shall be sealed as called for in the architectural plans and specifications.

I. Pull Cords: The Contractor shall furnish and install a full length, 3/32" nylon pull cord in every "empty" conduit installed hereunder to facilitate the future installation of wires. Identify each terminus of pull wire with linen tags with complete information as to service and location of the terminus of the cord.

J. Sealing Fittings: Install where required by the NEC, where conduits pass from warm to cold locations and where otherwise indicated.

K. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduit passing through walls. Sleeves that are used shall be caulked tight with an approved means to meet the assembly characteristics.

L. Identification: Identify all exposed raceways according to the system carried. Identify exposed conduits by an approved means. Provide legible lettering in contrasting colors. Abbreviate only when approved. Identification shall be placed at maximum intervals of twenty feet on straight conduit runs, close to all terminations, adjacent to all change in directions and where conduits pass through walls or floors.

3.2 CONDUIT SUPPORTS

A. Supports: Provide supports for horizontal conduits and EMT not more than 8 feet apart with not less than two supports for each 10-foot straight length and one support near each elbow or bend including runs above suspended ceilings and within 3 feet of all junction boxes, switches, fittings, etc.

B. Straps: Install one hole pipe straps on conduits 1.5 inch or smaller. Install individual pipe hangers for conduits larger than 1.5 inch. Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.

C. Trapezes: Install multiple (trapeze) pipe hangers where two or more horizontal conduits or EMT run parallel and at the same elevation. Secure each conduit or EMT to the horizontal hanger member by a U-bolt, one hole strap or other specially designed and approved fastener.

D. Hanger Rods: Install 1/4-inch diameter or larger galvanized steel rods for trapezes, spring steel fasteners, clips, and clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.

E. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts to brickwork by means of expansion bolts and to hollow masonry by means of toggle bolts. Wooden plugs and shield shall not be used. Power driven fasteners may be used to attach pipe straps and hanger rods to concrete only where approved by the Engineer.

F. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy fasteners of ERICO Products, Inc. Wire wrapped around conduits and supporting members will not be accepted.

G. On Roof: All conduits laid on roof shall be supported by an approved means utilizing a UL listed product for the purpose.

H. Lay-in Ceiling: Conduits routed above acoustical "lay-in" ceilings shall be anchored to the building structure and not laid on the ceiling. Wire shall not be used to anchor boxes to structure. If ceiling support system is adequate, one 3/4" maximum conduit may be supported by a Caddy Clip to an identified hanger wire. Multiple runs of conduit shall be racked on trapeze hanger. All support materials shall be rustproof. Perforated tape or soft iron wire shall not be used.

3.3 CONDUIT STUB-UPS

A. Conduits run under floor shall be stubbed up to a coupling set flush with floor. This excludes conduits stubbed up in walls and feeder conduits. Install flush plug until after floor is finished, then complete connections to boxes or equipment.

3.4 OUTLET BOXES

A. Outlet Boxes: Outlet boxes, covers and fittings, according to the particular use for which they are required, shall be provided in the locations marked on the drawings by symbols, and/or for use to facilitate the installation of the electrical systems. When necessary, outlets shall be relocated so that when fixtures of other fittings are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment required by the drawings and/or specifications.

B. Installation: Unless otherwise specified or shown on the drawings, outlet boxes shall be flush mounted and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line or if installed in walls and ceilings of incombustible construction, not more than 1/4 inch back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. Boxes in plastered walls and ceilings shall be provided with plastic covers. A multiple of box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hangers, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steel work.

C. Mounting Heights: The mounting height of a wall mounted outlet box shall be construed to mean the height from the finished floor to the horizontal center line of the cover plate. On exposed tile, block or brick construction, mount outlet boxes at the nearest bed joint to the mounting height indicated. Wall Mounted Switch, Receptacle and Signal Outlets: On columns, pilasters, etc., mount so the centers of the columns are clear for future installation of partitions. Install outlet boxes near doors or windows close to trim. Install outlet boxes near the doors on the lock sides (see architectural drawings for correct door swings).

D. Identification: Identify all exposed junction boxes according to the system carried by an approved means with legible letters and contrasting colors and without abbreviations.

3.5 PULLBOXES

A. Provide additional pullboxes wherever necessary to meet requirements for maximum length of conduit runs and maximum numbers of bends.

3.6 FLOOR BOXES

A. Install level with top covers adjusted flush with finished floor or floor tile.

3.7 FIXTURE CONNECTIONS

A. Recessed or surface light fixtures in lay-in or accessible ceilings shall be connected with flexible metallic conduit, 4 to 6 feet long with grounding provisions.

3.8 CLOSING OF OPENINGS

A. Wherever slots, sleeves or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, such openings, if unused, or the spaces left in such openings, shall be filled, or closed in an approved manner.

3.9 IDENTIFICATION

A. Refer to Section 260500 - GENERAL ELECTRICAL PROVISIONS for identification requirements for raceways and boxes.

END OF SECTION

SECTION 26 05 36 CABLE TRAY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install a complete cable tray system as specified herein. System shall be complete with all supports, mounting devices, etc., as required.

1.2 RELATED SECTIONS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of Division 26 Sections apply to this Section when applicable.

1.3 SUBMITTALS

A. Submit complete shop Drawings with outline dimensions, special installation instructions, materials list, catalog cuts, descriptive literature, and complete description of the cable tray system. Complete layout indicating all connections, locations and mounting shall be submitted.

PART 2 - PRODUCTS

2.1 GENERAL

A. Cable trays shall form a complete wireway system, and shall be of nominal 4-inch depth of aluminum. Wireways shall include splice, end plates, dropouts, and miscellaneous hardware. Wireways shall be supported at not more than 3'-6" intervals unless otherwise indicated. Contact surfaces of aluminum connections shall be coated with an antioxidating compound prior to assembly. All edges, fittings and hardware shall be finished free from burrs and sharp edges. Fittings shall have manufacturer's minimum standard radius unless otherwise indicated.

B. Ladder type cable trays shall be of nominal 12-inch width. Rung spacing shall be 6" maximum centers.

C. Cable trays run through smoke and fire partitions shall be sealed to preserve the smoke and fire rating of the partition assembly rating.

D. A no. 6 AWG bare copper or equivalent aluminum conductor shall be laid throughout the cable tray system and bonded to each section thereof. This conductor shall be connected to the building grounding system as required. Bonding of the conductor to the cable tray system shall be made by bolted or thermochemical type connections.

E. Cable tray system (tray, mounting brackets, anchors etc.) shall be seismically rated for the project location and approved by the structural engineer.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Cable tray shall be securely and rigidly fastened in place with approved pipe straps, wall brackets, clamps, fasteners, hangers, threaded C-clamps with retainers, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structures.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Underground warning tape.

1.2 RELATED SECTIONS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of Division 26 Sections apply to this Section when applicable.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Latest Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace; latest edition.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 – PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Switchboards:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
         3) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Motor Control Centers:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
         3) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      c. Panelboards:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
         3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         4) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      d. Transformers:
         1) Identify power source and circuit number. Include location when not within sight of equipment.

e. Enclosed switches, circuit breakers, and motor controllers:
   1) Identify voltage and phase.
   2) Identify power source and circuit number. Include location when not within sight of equipment.
f. Busway:
   1) Identify power source and circuit number. Include location when not within sight of equipment.
   2) Provide identification at maximum intervals of 40 feet (12 m).
   3) Use identification nameplate to identify load(s) served for each plug-in unit. Include location when not within sight of equipment.
g. Enclosed Contactors:
   1) Identify voltage and phase.
   2) Identify load(s) and associated circuits controlled. Include location.
h. Transfer Switches:
   1) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
   2) Identify load(s) served. Include location when not within sight of equipment.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
   b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
   c. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
3. Emergency System Equipment:
   a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
   b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
5. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches.
   b. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash hazard study performed in accordance with Section 26 0573:
      1) Include orange header that reads "WARNING" where calculated incident energy is less than 40 calories per square cm.
      2) Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.
      3) Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.

C. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less as follows:
      a. The phasing of all conductors (#6 and larger) shall be identified by color coding tape. Conductors sizes #8 and smaller shall have colored insulation. The grounded (neutral) conductor sizes #6 and smaller shall be white or light gray or have 3 continuous white stripes on other than green insulation. Grounded (neutral) conductors larger than size #6 shall be color coded white with coding tape. Grounding conductors sizes #6 and smaller shall have green insulation or be bare the entire length. Grounding conductors larger that size #6 shall be color coded green with coding tape.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premise has feeders or branch circuits served by more than one nominal voltage system.

D. Identification for Boxes:
   1. Use voltage markers to identify highest voltage present.
   2. Use voltage markers or color-coded boxes to identify systems other than normal power system.
      a. Color-Coded Boxes: Field-painted per the same color code used for raceways.
         1) Fire Alarm System: Red.

E. Buried Electrical Lines: Underground warning tapes.

F. Communication Cabinets: Nameplates.

G. Control Device Station: Labels.

H. Electrical Distribution and Control Equipment Enclosures: Nameplates.

I. Junction Box Load Connections: Wire markers.

2.2 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Other approved manufacturer(s) authorized by the engineer of record.

2.3 IDENTIFICATION NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background, unless indicated otherwise for nameplates for Essential Power System equipment.
   1. Engraving stock shall be melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
   2. Nameplates and labels shall have punched or drilled holes for mechanical fasteners.
   3. Nameplates and labels shall be fastened using self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts with flat and lock washers.

B. Locations:
   1. Each electrical distribution (switchboards, distribution panels and panelboards) and control equipment enclosure.
   2. Communication cabinets.
   3. All special systems cabinets.

C. Letter Size:
   1. Use 1/8-inch letters for identifying individual equipment and loads.
   2. Use 1/4-inch letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape, with 3/16-inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations, and identified specialized power devices.

2.4 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Legend: Power source and circuit number or other designation indicated.

C. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

D. Minimum Text Height: 1/8 inch.

E. Color: Black text on white background unless otherwise indicated.

F. Description: Vinyl cloth type self-adhesive wire markers.

G. Locations: Each conductor at panelboard gutters, pull boxes, and junction boxes each load connection.

2.5 UNDERGROUND WARNING TAPE

A. 4" Polyethylene tape, Foil-backed Detectable Type Colored Red Tape: 4" inches wide, with minimum thickness of 4 mil, with suitable warning legend describing buried systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

A. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker.

B. Install line marker for underground wiring, both direct buried cables and cables in raceway.

C. Paint fire alarm junction boxes red.

D. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout.

E. Electrical Gear and Equipment Identification Labels: Engraved plastic laminate shall be installed on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch-high lettering on 1-1/2-inch-high label. Where two lines of text are required, use labels that are 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of electrical gear and equipment using mechanical fasteners:
   1. Interior and exterior of switchgear, switchboards, distribution panelboards, panelboards, motor control centers, electrical cabinets, enclosures, and other equipment.
      a. Main Overcurrent Protection: Identify main device and service disconnects.
      b. Switchboards and Switchgear: Identify equipment, label main and distribution overcurrent protection showing load served and location (identify room numbers, where possible).
      c. Distribution Panelboards: Identify Distribution Panelboard designation and circuit serving distribution panelboard. Label main and distribution overcurrent protection showing load served and location (identify room numbers, where possible).
      d. Branch Panelboards: Identify distribution panel and circuit serving panelboard.
      e. Motor Control Centers: Identify equipment designation, voltage, phases, and full-load current capacity. Label main and distribution overcurrent protection.
      f. Disconnect Switches: Identify equipment designation, voltage and horsepower rating or full-load current capacity.
      g. Enclosed Circuit Breakers: Identify equipment designation, voltage, and full-load current capacity.
      h. Motor Starters: Identify equipment designation, voltage and horsepower rating or full-load current capacity.
      i. Power Transfer Equipment (Manual and Automatic): Identify equipment designation, power sources, voltage, and full-load current capacity.
   2. Identification Labels for Other Electrical Equipment: Engraved plastic laminate shall be installed on each unit of equipment. Unless otherwise indicated, provide a single line of text with 1/2-inch-high lettering on 1-1/2-inch-high label. Where two lines of text are required, use labels that are 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of electrical gear and equipment using mechanical fasteners:
      a. Transformers.
      b. Frequency converters.
      c. Power inverters.
      d. Lighting contactors.
      e. Push-button stations and other control stations or devices.
      f. Telephone switching equipment.
      g. Battery racks.
      h. Power-generating units.
      i. Nurse call system master station.
      j. Paging system master station.
      k. TV/audio-monitoring master station.
      l. Fire alarm system master station or control panel.
      m. Fire alarm system extender or battery panel.
      n. Security-monitoring master station or control panel.
      o. Master clock or program equipment.

F. Provide framed, typed circuit schedules for all panelboards with explicit description and identification of items controlled by each individual circuit breaker.
   1. Panelboards: Identify existing circuits as well as new circuits with new, typed circuit schedules.
      a. 208 Volt System: Black
      b. Other Special Systems: Yellow.

G. Circuit Identification Labels: Provide external labels for all installed device face covers and junction boxes prior to installation of conductors. Circuit identification shall be as shown below.
   1. Labeling Legend for Junction Boxes: Provide permanent, waterproof label listing panel and circuit number.
   2. Labeling Legend for Device Face Covers in Patient Care Areas, as defined by NEC Article 517: Provide permanent, adhesive label listing the panel and circuit number.
   3. Circuit Identification Labels on Cover or Face Plates: Install labels externally for all installed wiring device plates indicating panel and circuit number.
      a. Clear preprinted adhesive labels.

H. Color-Coding for Secondary Phase Conductors: Color code switch legs, travelers, and other wiring for branch circuits other than those listed below. Permanently post color code at each branch panelboard. Use the following colors for service, feeder, and branch-circuit phase conductors:
   1. 208/120-Volt, 3-Phase System Conductors:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
      d. Neutral (Common): White.
      e. Ground (Earth): Green.
   2. 480/277-Volt, 3-Phase System Conductors:
      a. Phase A: Brown.
      b. Phase B: Orange.
      c. Phase C: Yellow.
      d. Neutral (Common): Gray.
      e. Ground (Earth): Green.

I. Circuits Operating at More Than 600 Volts: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:
   1. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
   2. Wall surfaces directly external to conduits concealed within wall.
   3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
   4. Entire surface of exposed conduits.

J. Electrical identification in healthcare facilities shall comply with the following requirements:
   1. All electrical outlets in patient care areas, as defined in NEC 517, shall have a permanent label affixed to the faceplate cover indicating the panel name and circuit number feeding that outlet.
   2. All electrical switches in patient care areas, as defined in NEC 517, shall have a permanent label affixed to the faceplate cover indicating the panel name and circuit number feeding that outlet.
   3. Labeling on faceplate covers in Critical Care Units (CCU), Neonatal Intensive Care Units (NICU's), Intensive Care Units (ICU's), Operating Rooms (OR's) and other similar areas in healthcare facilities shall be accomplished by permanently engraving the faceplate cover with the panel name and circuit number feeding that outlet or switch.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 05 73 SHORT-CIRCUIT/ COORDINATION STUDY/ ARC FLASH RISK ASSESSMENT

PART 1 - GENERAL

1.1 SCOPE

A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer or an approved engineering firm.

B. The contractor shall furnish an Arc Flash Risk Assessment Study per the requirements set forth in NFPA 70E - Standard for Electrical Safety in the Workplace. The Arc Flash Risk Assessment shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E, Annex D.

C. The scope of the studies shall include all new electrical distribution equipment supplied by the equipment manufacturer under this contract as well as all directly affected existing electrical distribution equipment at the customer facility.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
   2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
   3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
   4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
   5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
   6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):
   1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
   2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
   3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
   4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)
   1. NFPA 70 - National Electrical Code, latest edition
   2. NFPA 70E – Standard for Electrical Safety in the Workplace, latest edition

D. American Society for Testing and Materials
   1. ASTM F1506 – Standard Performance Specification for Flame Resistant and Electric Arc Rated Protective Clothing Worn by Workers Exposed to Flames and Electric Arcs

1.4 SUBMITTALS FOR REVIEW/APPROVAL

A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.5 SUBMITTALS FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash risk assessment studies, including all drawings, shall be summarized in a final report. The report shall include pdfs of all documents in the report

and shall include the AutoCAD format drawings required by the study, and shall include the SKM PTW Backup of the project file.

B. The contractor is required to provide the study SKM PTW Backup project files to the Owner in electronic format. The electronic format files shall be compatible with SKM licensed software, latest version.

C. The report shall include the following sections:
   1. Executive Summary.
   2. Descriptions, purpose, basis and scope of the study
   3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties
   4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection
   5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
   6. Details of the incident energy and flash protection boundary calculations
   7. Recommendations for system improvements, where needed
   8. SKM one-line diagrams showing the SKM system one-line diagrams with the SKM datablock showing the following. The SKM one-lines shall be totally created within the SKM project software. All SKM one-lines shall be viewable with the SKM PTW software project.
      a. Cable size and quantity and length
      b. Bus name and incident energy at working distance
      c. Device name and symbol including, but not limited to, disconnect switches, circuit breakers, MCPs, fuses, VFDs, transformers, UPSs, starters, motors, cables, capacitors, reactors, generators, non-motor loads, transfer switches, and other symbols as required
      d. Device name and frame/model number
      e. Device name and frame/model and sensor trip for fuses
      f. Device name and frame/model and sensor/trip and plug and settings for circuit breakers
      g. Other data pertinent to the study.
   9. AutoCAD one-line diagram(s) modeling the complete electrical system. This includes all three phase circuits and all single phase circuits larger than 20 amperes.
   10. AutoCAD building floor plan(s) showing the location and component name of all electrical devices to receive an arc flash label.
   11. Drawing sizes: Single line diagrams created in SKM, AutoCAD location floor plans and AutoCAD single line diagrams shall be sized to ANSI D drawing size such that when printed on an ANSI B drawing size (11x17 inches Tabloid) print that the content and text are readable without the use of a magnifying instrument. North Arrows representing true North and graphic scale shall be placed on all plan drawings.
   12. Photographs: Provide photograph files of all equipment that is included in the Arc Flash Study. Photograph file names shall reflect equipment in the photograph. Photograph names shall begin with the building number. Photograph file format shall be jpg format or other common file format as approved by the Owner. Photograph density shall be 10 megapixel or better. All images, including text and symbols, etc, shall remain in focus when using the zoom-in feature of the viewing software of at least 400 percent zoom. Photographs subject matter shall include location, nameplates or markings, manufacturer model number and catalog number, ampere and voltage ratings, manufacturer nameplate catalog number, series number, protective devices and data, etc.

D. Arc flash labels shall be provided in hard copy using the PTW arc flash label format provided to the Study Provider. Stick-on arc flash labels shall not be provided until the complete study has final approval of the Owner. Copies of labels shall be provided in PDF format for approval purposes.

1.6 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash risk assessment studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm performing the studies.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies of similar scope and size of studies required herein.

D. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Risk Assessment by submitting names of at least three (3) actual arc flash risk assessment studies using the Incident Energy Analysis Method it has performed in the past year.

1.7 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using the latest revision of the SKM Systems Analysis Power*Tools for Windows (PTW) software program.

B. SKM has an extensive library including, but not limited to, library files for circuit breaker trip units, fuses, conductors, etc. However, in the event that SKM does not have in their standard library the files and data for the actual devices and equipment encountered in the facility under study, it is the Contractor's responsibility to obtain the necessary and required files and data from SKM, and to obtain any and all other data and information to complete the arc flash and other studies specified herein.

PART 2 - PRODUCT

2.1 STUDIES

A. Contractor to furnish short-circuit and protective device coordination and equipment evaluation studies as prepared by equipment manufacturer or an approved engineering firm.

B. The contractor shall furnish an Arc Flash Risk Assessment Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.5, Article 130.5(G) and Annex D. Arc Flash Risk Assessment shall use the Incident Energy Analysis Method per NFPA 70E - 2021, Article 130.5(G).

C. All three phase circuits are to be included in the study. All phase-to-phase two pole circuits 20 amps and larger feeding equipment, such as non-fused and fused disconnect switches, and/or likely to require inspection shall be included in the study. Individual single phase and phase-to-phase two pole circuits rated less than 20 amps feeding general purpose receptacles shall not be included in the studies.

D. Calculations for all voltages and transformer kVA sizes shall be from equations.

2.2 DATA COLLECTION

A. Contractor shall collect and furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash risk assessment studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination shall include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required equipment data, as necessary, to satisfy the study requirements.

E. Data Collection shall be the responsibility of the Contractor and shall include, as a minimum, the following:
   1. Manufacturer of all protective devices required for the studies, including but not limited to:
      a. Circuit breakers, catalog number, model numbers, series number, etc.
      b. Circuit breaker trip types and ranges, sensor sizes, catalog number and ranges in amperes
      c. Disconnect switches
      d. Fused Disconnect switches
      e. Fuse types and ampere ratings
      f. Electronic/solid state trip units including all functions and ranges
      g. All existing settings of protective devices
      h. Date of manufacture
      i. Ampere interrupting rating, including load break rating, AIC and momentary ratings in kA and voltage ratings
      j. Conductor sizes, types, lengths, types of raceway, etc.
      k. Relay setting, current transformer ratios
      l. Generator short-circuit characteristics

2. Verify nomenclature to be used for all components and all devices in the study with the Owner.
3. Field inspections shall be coordinated with the Owner and shall be performed complying with the Owners safety requirements and applicable electrical work safety standards.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.

B. Transformer design impedances shall be used when test impedances are not available.

C. Provide the following:
1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Tabulations of calculated quantities
6. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
1. Electric utility's supply termination point
2. Incoming switchgear
3. Unit substation and/or pad mounted service transformers primary and secondary terminals
4. Low voltage switchgear or switchboard
5. Step-down and/or step-up transformers
6. Motor control centers
7. Standby and/or emergency generators
8. Branch circuit panelboards and/or distributions boards
9. Disconnect switches, fused and non-fused
10. Adjustable speed drives
11. Automatic and manual transfer switches both normal and emergency supply
12. Automatic and manual transfer switches load side considering separately the normal and emergency power sources mode
13. All three (3)-phase circuits and other circuits as specified herein.
14. Other significant loads throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to available voltage and short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboards and other system equipment to withstand available voltage and short-circuit stresses
3. Notify Owner in writing of circuit protective devices improperly specified or rated for the available voltage and phase and calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered with the one-line diagram on the left and the TCC on the right side using 11 inch x 17 inch landscape format as approved by the Owner.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:
1. Electric utility's overcurrent protective device
2. Medium voltage equipment overcurrent relays

3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH RISK ASSESSMENT

A. The Arc Flash Risk Assessment shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. The Arc Flash Risk Assessment shall include all locations for all voltages including 240 volt and 208 volt systems regardless of transformer kVA size to which the circuits are connected. The exception for these systems fed from transformers equal to or less than 125kVA shall not be allowed.

D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2. The selection of arc-rated clothing and other PPE shall be based on NFPA 70E-2021, Table 130.5(G). For incident energy exposures less than 1.2 cal/cm^2 , PPE shall meet the requirements of NFPA 70E-2021 and ASTM F1506 as a minimum.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location. However, the arc flash label provided shall be provided with results based on the protective device closest to and immediately ahead of the faulted bus.

K. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.6 REPORT SECTIONS

A. Input data shall include, but not be limited to, the following:
   1. Feeder input data including feeder type (cable or bus), insulation material, size, actual circuit length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
   2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.
   3. Reactor data, including voltage rating, and impedance.
   4. Generation contribution data, (synchronous generators and Utility), including short-circuit sub-transient reactance (X”d), rated MVA, rated voltage, three-phase and single line- ground contribution (for Utility sources) and X/R ratio.
   5. Motor contribution data (induction motors and synchronous motors), including short- circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.

B. Short-Circuit Output Data shall include, but not be limited to, the following reports:

   1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
      a. Voltage
      b. Calculated fault current magnitude and angle
      c. Fault point X/R ratio
      d. Equivalent impedance
   2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
      a. Voltage
      b. Calculated symmetrical fault current magnitude and angle
      c. Fault point X/R ratio
      d. Calculated asymmetrical fault currents
         1) Based on fault point X/R ratio
         2) Based on calculated symmetrical value multiplied by 1.6
         3) Based on calculated symmetrical value multiplied by 2.7
      e. Equivalent impedance
   3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
      a. Voltage
      b. Calculated symmetrical fault current magnitude and angle
      c. Fault point X/R ratio
      d. No AC Decrement (NACD) Ratio
      e. Equivalent impedance
      f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
      g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis

C. Recommended Protective Device Settings:
   1. Phase and Ground Relays:
      a. Current transformer ratio
      b. Current setting
      c. Time setting
      d. Instantaneous setting
      e. Recommendations on improved relaying systems, if applicable.
   2. Circuit Breakers:
      a. Adjustable pickups and time delays (long time, short time, ground)
      b. Adjustable time-current characteristic
      c. Adjustable instantaneous pickup
      d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations
   1. Arcing fault magnitude
   2. Protective device clearing time
   3. Duration of arc

4. Arc flash boundary
5. Working distance
6. Incident energy
7. PPE
8. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Owner in writing of any required major equipment modifications.

D. Any and all equipment shutdowns and/or de-energizations shall be submitted in writing to and approved by the Owner in writing prior to these equipment shutdowns and/or de- energizations.

3.2 ARC FLASH WARNING LABELS

A. The contractor of the Arc Flash Risk Assessment shall provide a 3.33 in. x 4 in. laser printed type label of high adhesion polyester for each work location analyzed. Labels shall be manufactured by Avery, Number 5524, no substitutions.

B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the Owner and after any approved system changes, upgrades or modifications have been incorporated in the system.

C. The label shall include the following information, at a minimum as contained in the SKM label form to be given to the study contractor:
1. Flash Protection Boundary
2. Incident Energy
3. Working Distance
4. PPE
5. Nominal system voltage
6. Shock Risk When Cover Is Removed
7. Glove Class
8. Limited Approach
9. Restrictive Approach
10. Location Designation
11. Protective Device
12. Maximum Short Circuit Amperes
13. Issue Date.

D. Labels shall be laser ink jet machine printed, with no field markings. On the Arc Flash labels, the “LOCATION” field and the “PROTECTIVE DEVICE” field are intended to be descriptive of the item for which the incident energy is being calculated and displayed and for the protective device that provides overcurrent protection for the item described in the “LOCATION” field. The “LOCATION” description is to include the building number as the first four digits of the component name followed by the name and number of the item. The “PROTECTIVE DEVICE” description is to include the building number as the first four digits of the component name followed by the name of the item or device that contains the protective device followed by the position numbers in the device containing the overcurrent device. Some examples are as follows:
1. “LOCATION”: XXXX PANEL LP1 “PROTECTIVE DEVICE”: XXXX PNL 1DPB – 37/39/41
2. “LOCATION”: XXXX AHU1 DSw “PROTECTIVE DEVICE”: XXXX MCC2 – 3F
3. “LOCATION”: XXXX CTwr P – 1 VFD “PROTECTIVE DEVICE”: XXXX MDP – 12/14/16
4. In general, component names should be names of the actual equipment encountered in the arc flash study.

E. Arc flash labels shall be provided in the following manner and all labels shall be based on approved overcurrent device settings:

1. Panelboards and/or distribution panels, one or more arc flash labels shall be provided
2. For each motor control center, one or more arc flash labels shall be provided
3. For each low voltage switchboard, one or more arc flash labels shall be provided
4. For each switchgear, one or more arc flash labels shall be provided. Additional labels are required for rear accessible gear.
5. For medium voltage switches, one arc flash label shall be provided
6. For each step-down and/or step-up transformer, two arc flash labels shall be provided, one for the primary side and one for the secondary side
7. Fused or non-fused individual disconnect switches, one arc flash label shall be provided
8. Individual motor controller, one arc flash label shall be provided
9. Automatic and/or manual transfer switches, provide one label for the normal supply side, one label for the emergency supply side, and multiple labels may be required for the transfer switch load side circuits based on incident energy calculated
10. Individual circuit breakers, one arc flash label shall be provided
11. Variable(adjustable) speed controllers, one arc flash label shall be provided. Additional labels may be required depending on the variable(adjustable) speed controller operating mode.

F. In the event that equipment evaluated in the study fails the equipment evaluation report, a label shall be provided similar to the Arc Flash label except with a red background with the word DANGER, in black letters, printed at the top of the label. However, arc flash information shall not be included on the label. The label shall also include appropriate wording to indicate that the equipment is to be de-energized prior to being worked on. The fields for LOCATION, PROTECTIVE DEVICE and MAXIMUM SHORT CIRCUIT AMPERES shall also be included on the label.

G. Labels shall be field installed by the Arc Flash study contractor.

3.3 ARC FLASH TRAINING

A. As an option, the contractor of the Arc Flash Risk Assessment shall train the owner's qualified electrical personnel of the potential arc flash risks associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent.

END OF SECTION

SECTION 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The purpose of this section is to specify the Division 26 responsibilities and participation in the commissioning process.

B. Work under this contract shall conform to requirements of Division 01, General Requirements, Conditions of the Contract, and Supplementary Conditions. This specification covers commissioning of electrical systems which are part of this project.

C. Commissioning work shall be a team effort to ensure that all electrical equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and document system performance. Commissioning shall coordinate system documentation, equipment start-up, and verification and performance testing.

D. The commissioning team shall be made up of representatives from the University, design professionals, major equipment suppliers, and construction trades. The trades represented on the commissioning team shall include, but not be limited to, sheet metal, piping and fitting, controls, test, and balance, and electrical. The lead person for each trade who will actually perform or supervise the work is to be designated as the representative to the commissioning team. Responsibility for various steps of the commissioning process shall be divided among the members of the commissioning team, as described in this section.

E. The Commissioning Authority shall have responsibility for coordinating and directing each step of the commissioning process. The Authority shall be a true third party, not affiliated with any of the companies involved with the project design.

F. Electrical system installation, start-up, testing, preparation of O&M manuals, and operator training are the responsibility of the Division 26 Contractors, with coordination, observation, verification and commissioning the responsibility of Division 01, Section 01 9113. The 01 9113 commissioning process does not relieve Division 26 from the obligations to complete all portions of work in a satisfactory and fully operational manner.

G. Refer to Division 01, Section 01 9113, for a full list of commissioning related definitions. A few critical definitions are included below:
   1. *Commissioning*. A systematic process that provides documented confirmation that specific and interconnected fire and life safety systems function according to the intended design criteria set forth in the project documents and satisfy the University's operational needs, including compliance requirements of any applicable laws, regulations, codes, and standards requiring fire and life safety systems.
   2. *Commissioning Authority (CxA*). The qualified person, company, or agency that plans, coordinates, and oversees the entire Cx process.
   3. *Commissioning Plan*. The document prepared for each project, which identifies the processes and procedures necessary for a successful Cx process.
   4. *Commissioning Record*. The complete set of commissioning documentation for the project, which is turned over to the University at the end of the construction phase.
   5. *Functional Testing.* Tests performed to verify compliance with manufacturers' specifications, applicable codes and standards, and the project BOD and OPR.

1.2 RELATED SECTIONS

A. Division 01 Section 01 9113 - General Commissioning Requirements

B. Division 22 Section 22 0800 - Commissioning of Plumbing Systems

C. Division 23 Section 23 0800 - Commissioning of HVAC Systems

D. Division 27 Section 27 0800 - Commissioning and Acceptance

E. Individual Division 01, 21, 22, 23, 25, 26, and 27 sections contain requirements related to the commissioning process

1.3 ROLES AND RESPONSIBILITIES

A. Refer to Section 01 9113 for Commissioning Authority, University, Architect, and General Contractor roles and responsibilities.

B. Refer to Section 22 0800 for plumbing contractor roles and responsibilities

C. Refer to Section 23 0800 for HVAC contractor roles and responsibilities

D. Refer to Section 27 0800 for communications contractor roles and responsibilities

E. Electrical Contractor
1. Include cost to complete commissioning requirements for electrical systems in the contract price
2. Include requirements for submittal data, O&M data, and training in each purchase order or subcontract written
3. Ensure cooperation and participation of specialty sub-contractors such as communications, data, etc.
4. Ensure participation of major equipment manufacturers in appropriate training and testing activities
5. Attend Construction Phase coordination meeting scheduled by the Commissioning Authority
6. Conduct electrical system orientation and inspection when equipment is set
7. Respond to (in writing) and address items documented in the Contractor Commissioning Issues Log
8. Submit copies of all test results to the CxA
9. Complete Pre-Functional Checklists for all equipment.
   a) If no other system is agreed upon by Commissioning Team, Mechanical Contractor shall be responsible for completion of Pre-Functional Checklists for all equipment for which it issued a purchase order.
   b) Mechanical Contractor shall coordinate completion of Pre-Functional Checklists with all other contractors that have made connections to equipment for which it issued a purchase order.
   c) Remedy any deficiencies identified in Pre-Functional Checklists and notify CxA in writing that deficiencies have been addressed.
10. Assist the Commissioning Authority in all Pre-Functional Checklist verifications and Functional Performance Tests.
11. Prepare preliminary schedule for electrical system orientation and inspections, O&M manual submission, training sessions, emergency generator testing, equipment start up, and task completion for use by the Commissioning Authority. Update schedule as appropriate throughout the construction period.
12. Attend initial training session.
13. Conduct electrical system orientation and inspection at the equipment placement completion stage.
14. Update drawings to the record condition to date, and review with the Commissioning Authority.
15. Gather O&M data on all equipment, and assemble in binders as required by the Commissioning Specification. Submit to Commissioning Authority for review prior to the completion of construction.
16. Notify the Commissioning Authority a minimum of two weeks in advance, so that witnessing equipment and system start-up and testing can begin.
17. Participate in, and schedule vendors and Contractors to participate in the training sessions as set up by the Commissioning Authority.
18. Provide a complete set of as-built records to the Commissioning Authority.

F. Equipment Suppliers and Miscellaneous Contractors
1. Include cost for commissioning requirements in the contract price.
2. Provide submittals, and appropriate O&M manual section(s).
3. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
4. Participate in training sessions as scheduled by the Commissioning Authority.
5. Demonstrate performance of equipment as applicable.

1.4 SCOPE OF WORK

A. Commissioning work of Division 26 shall include, but not be limited to:
1. Testing and start-up of the equipment.
2. Completion of Functional Checklists.
3. Cooperation with the Commissioning Authority.
4. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial testing.
5. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
6. Providing operation and maintenance manuals, and as-built drawings to the Commissioning Authority for verification.
7. Providing training and demonstrations for the systems specified in this Division.

B. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be evaluated:
   1. Indoor lighting and controls including power transfer schemes, emergency lighting, and outdoor lighting.
   2. Emergency power monitoring and operation
   3. Electrical support for mechanical equipment listed in Section 23 0800 - Commissioning of HVAC Systems

C. System components which will not be functionally performance tested but will be included in the commissioning scope for conformance to the design documents, verification of specified Contractor testing, construction phase observation, and training verification shall include:
   1. Primary switchgear
   2. Primary transformer
   3. Main switchgear
   4. Distribution switchgear
   5. Distribution Switchboards
   6. Panel boards
   7. Isolation power systems
   8. Power conditioners
   9. Power factor correction
   10. Paralleling gear
   11. Automatic transfer switch
   12. Lighting protection
   13. Grounding system
   14. SCADA system
   15. Lighting and lighting controls

D. Timely and accurate documentation is essential for the commissioning process to be effective. Documentation required as part of the commissioning process shall include but not be limited to:
   1. Commissioning Process Reports, which may include the following:
      a) Commissioning Field Reports
      b) Design Team Issues Log
      c) Contractor Commissioning Issues Log on the WCxS
      d) Meeting minutes
   2. Pre-start, and start-up procedures
   3. Pre-functional Checklists
   4. Functional Test Procedures
   5. Training agenda and materials
   6. As-built records
   7. Commissioning report
   8. Operation and maintenance (O&M) manuals
   9. Mapping of reports into maintenance programs

E. Detailed testing shall be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. All tests shall be witnessed by the Commissioning Authority. The following testing is required as part of the commissioning process:
   1. Functional Checklists are comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract documents. Verification is completed by the Division 23, 26, and 28 contractors and documented using Functional Checklists.
   2. Functional Performance Tests (FPT) shall determine if the electrical system is operating in accordance with the design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.

F. Comprehensive training of O&M personnel shall be performed by the Electrical Contractor, and where appropriate, by other sub-contractors, and vendors prior to turnover of building to the University. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems.

1.5 DOCUMENTATION

A. The Commissioning Authority shall oversee and maintain the development of the document process. The GC shall facilitate project documentation through the web-based commissioning software. The commissioning documentation shall include, but not be limited to, the following:
   1. Commissioning Plan
   2. Commissioning Schedule
   3. Document Request Log

4. Commissioning RFIs
5. Commissioning Field Reports
6. Design Team Issues Log on the WCxS
7. Contractor Commissioning Issues Log on the WCxS
8. Pre-Functional Checklists
9. Functional Performance Tests

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The appropriate Contractor(s) shall furnish all special tools and equipment required for testing during the commissioning process. A list of all tools and equipment to be used during commissioning shall be submitted to the Commissioning Authority for approval. The University shall furnish necessary utilities for the commissioning process.

2.2 TEST EQUIPMENT – PROPRIETARY

A. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the University upon completion of the commissioning process.

PART 3 - EXECUTION

3.1 GENERAL

A. A pre-construction meeting of all commissioning team members shall be held at a time and place designated by the University. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.

B. The Contractor shall complete all phases of work so the systems can be started, tested, balanced, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.

C. A Commissioning Plan shall be developed by the Commissioning Authority. The Contractor shall assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If contractor-initiated system changes have been made that alter the commissioning process, the Commissioning Authority shall notify the University.

D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems and shall be coordinated with the Division 26 contractor. Start of acceptance procedures before system completion does not relieve the contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

A. The Contractor shall provide skilled technicians to start-up and debug all systems within Division 26. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the Commissioning Authority and coordinated by the contractor. Contractor shall ensure that the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

B. System performance problems and discrepancies may require additional technician time, Commissioning Authority time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.

C. The Commissioning Authority reserves the right to question the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians shall include expert knowledge relative to the specific equipment involved and a willingness to work with the Commissioning Authority. Contractor shall provide adequate documentation and tools to start-up and test the equipment, system, and/or sub- system.

3.3 DEFICIENCY RESOLUTION

A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the University, with input from the contractor, equipment supplier, and Commissioning Authority. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the University shall have final jurisdiction over any additional work done to achieve performance.

B. Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Authority shall notify the University, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the University reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner shall be the contractor's responsibility.

C. The University's contract with the Commissioning Authority includes up to two tests of each piece of equipment or system included in the commissioning scope. Commissioning Authority time and expenses required for retests beyond two, if required, due to incomplete installation or otherwise, will be paid by the University and reimbursed by the contractor.

3.4 ADDITIONAL COMMISSIONING

A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The contractor(s), suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their contractual obligations.

3.5 SEASONAL COMMISSIONING

A. Seasonal commissioning pertains to testing under full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Initial commissioning shall be done as soon as contract work is completed, regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.

B. Heating equipment shall be tested during winter design extremes. Cooling equipment shall be tested during summer design extremes with a fully occupied building. Each contractor and supplier shall be responsible to participate in the initial and the alternate peak season tests of the systems as required to demonstrate performance.

3.6 CONSTRUCTION PHASE OBSERVATION

A. Scope of Construction Phase Observation
   1. The Commissioning Authority will conduct periodic observations during the construction phase to monitor progress and compliance with the design intent and contract documents.
   2. Commissioning Authority observations will coincide with design team observations and are not intended to take the place of this work.

B. Documentation and Reporting
   1. Issues identified by the Commissioning Authority during construction phase will be documented on the Issues Log on the WCxS and distributed to Commissioning Team members.
   2. Progress during the construction phase will also be documented by the Commissioning Authority using Commissioning Process Reports.

3.7 ACCEPTANCE PROCEDURES

A. Pre-Functional Checklists
   1. Scope of Pre-Functional Checklists
      a) Tests and verifications included in the Pre-Functional Checklists shall determine if all components, equipment, systems, and interfaces between systems are installed and are ready to operate in accordance with contract documents.
   2. Participants in Pre-Functional Checklists: The Commissioning Authority shall be responsible for preparing the scope of these checklists, which will be completed by the installing contractors and then verified (via spot checking and Functional Performance Testing). Participating contractors, manufacturers, suppliers, etc. shall include all costs to do the work involved in these tests in their proposals. Following is a list of tasks and supporting information that shall be required:

a) HVAC Contractor - provide the services of a technician(s) who is (are) familiar with the construction and operation of this system. Provide access to the contract plans, shop drawings, and equipment cut sheets of all installed equipment.
b) Controls Contractor - provide the services of a controls engineer who is familiar with the details of the project. Provide details of the control system, schematics, and a narrative description of control sequences of operation.
c) Electrical Contractor - provide a foreman electrician familiar with the electrical interlocks, interfaces with emergency power supply, and interfaces with alarm and life-safety systems. Provide access to the contract plans, and all as-built schematics of sub-systems, interfaces, and interlocks.

3. Documentation and Reporting Requirements
   a) Pre-Functional Checklists shall be provided for each component, piece of equipment, system, and sub-system, including all interfaces, interlocks, etc. Each item to be tested shall have a different entry line with space provided for comments. The checklists will include spaces for each party to sign off on.
   b) Completed checklists shall be submitted to the Commissioning Authority for acceptance and inclusion in the commissioning report.
4. Acceptance of Pre-Functional Checklists
   a) The Commissioning Authority will select, at random, 10% of the checklists for verification, 100% of the Fire Alarm checklist.
   b) If 10% or more of the checklists are found to be inaccurate for each system or equipment type, all of the checklists for that system or equipment type will be rejected. Complete, accurate checklists will need to be resubmitted.

B. Functional Performance Testing
1. Scope of Functional Performance Testing
   a) Functional performance tests shall determine if the electrical system is operating in accordance with the final design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.
2. Submittals
   a) Detailed procedures for each series of tests will be developed by the Commissioning Authority for review and acceptance by the University. The procedures shall include samples of the data sheets that will be part of the reports.
3. Participants in Functional Performance Tests
   a) Participants in the functional performance tests shall be the same as those listed in the Functional Checklists.
4. Functional Performance Test Procedures
   a) The Commissioning Authority shall supervise and direct all functional performance tests.
      1) Set the system equipment into the operating mode to be tested (i.e. normal shut-down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
      2) The Commissioning Authority shall inspect and verify the position of each device and interlock identified in the test procedure. Each item shall be signed off as acceptable (yes) or failed (no).
      3) This test shall be repeated for each operating cycle that applies to the mechanical system being tested.
      4) Operating checks shall include all safety cutouts, alarms, and interlocks with smoke control and life safety systems during all modes of operation of the electrical system.
      5) If during a test an operating an operating deficiency is observed, appropriate comments will be added to the web-based commissioning software.
   b) If deficiencies are identified during Functional Performance Testing, the Construction Manager/General Contractor will be notified, and action taken to remedy the deficiency. The final completed functional test procedures on the WCxS will be reviewed by the Commissioning Authority to determine if testing is complete and the system is functioning in accordance with the contract documents.
5. Documentation and Reporting Requirements
   a) All measured data, data sheets, and a comprehensive summary, describing the operation of the electrical system at the time of testing shall be submitted to the Commissioning Authority.
   b) A preliminary functional performance test report shall be prepared by the Commissioning Authority and submitted to the Design Professional for review. Any identified deficiencies need to be evaluated by the Design Professional and Construction Manager/General Contractor to determine if they are part of the contractor’s or sub-contractor’s contractual obligations. Construction deficiencies shall be corrected by the responsible contractor(s), and the specific functional performance test repeated.
   c) If it is determined that the electrical system is constructed in accordance with the contract documents, and the performance deficiencies are not part of the contract documents, the University must decide whether any required modifications needed to bring the performance of the electrical

system up to the finalized design intent shall be implemented, or if the test shall be accepted as submitted. If corrective work is performed, the University shall determine if a portion or all required functional performance tests should be repeated, and a revised report submitted.

3.8 SYSTEMS MANUAL

A. The Systems Manual shall be submitted in paper and/or electronic format and shall contain the following major sections:
   1. System Descriptions:
      a) Each major system shall be described, typewritten, in general terms, including major components, interconnections, theory of operation, theory of controls, unusual features and major safety precautions. This information should correlate with information provided in the manufacturers' instructions book. This section shall include, but not be limited to, the following data:
         1) Detailed description of each system and each of its components with diagrams and illustrations where applicable.
         2) Wiring and control diagrams with data to explain detailed operation and control of each component
         3) Control sequences describing start-up, all modes of operation, and shut down
         4) Corrected shop drawings
         5) Approved product data including all performance curves and rating data
         6) Copies of approved certifications and laboratory or factory test reports (where applicable)
         7) Copies of warranties
      b) System diagrams, described in the following section, shall be incorporated in the appropriate systems descriptions. These should be reduced in size or folded to usefully fit into the manual.
   2. Operating Instructions:
      a) Condensed, typewritten, suitable for posting, instructions shall be provided for each major piece of equipment. Where more than one (1) common unit is installed, one instruction is adequate. The instructions shall provide procedures for:
         1) Starting up the equipment/system
         2) Shutting down the equipment/system
         3) Operating the equipment in emergency or unusual conditions
         4) Safety precautions
         5) Trouble shooting suggestions
         6) Other pertinent data applicable to the operation of particular systems or equipment
      b) The instructions shall be suitable for posting adjacent to the equipment concerned.
      c) The contractor shall provide instructions for (at minimum):
         1) Transformers
         2) Primary switchgear and substations
         3) Secondary Switchgear and Switchboards
         4) Electrical distribution systems
         5) Lighting control systems
         6) Fire alarm systems
         7) Security systems
         8) Paging systems
   3. Ongoing and Preventive Maintenance:
      a) Condensed, typewritten procedures for recommended ongoing and preventive maintenance actions shall be provided for each category of equipment/system listed above. This information shall include, but not be limited to the following:
         1) Maintenance and overhaul instructions.
         2) Parts list, including source of supply and recommended spare parts.
         3) Name, address, and 24-hour telephone number of each subcontractor who installed equipment and systems, and local representative for each type of system.
         4) Other pertinent data applicable to the maintenance of particular systems or equipment.
      b) These recommended preventive maintenance actions shall be categorized by the following recommended frequencies:
         1) Weekly
         2) Monthly
         3) Quarterly
         4) Semi Annual
         5) Annual
         6) Other

B. Posted Operating Instructions and Diagrams:
   1. Operating Instructions:
      a) Copies of operating instructions provided in the operating manual shall be posted in the near vicinity of each piece of applicable equipment. The instructions shall be mounted neatly in frames under

Plexiglas, where they can be easily read by operating personnel. Instructions mounted outdoors shall be suitably protected from weather.

2. Posted Systems Diagrams:
   a) Simplified one-line diagrams of the systems listed shall be developed using AutoCAD and posted neatly under Plexiglas in the main or most appropriate equipment room for easy reference by operating and maintenance personnel. These drawings shall be done in a professional manner which is acceptable to the University. The diagrams shall show each component including all devices installed in the system, with name and identifying number. Explanatory notes, where needed, shall be provided.
      1) Electrical one-line diagrams
      2) Other systems as applicable
      3) Emergency lighting
      4) Grounding System
   b) These diagrams shall be suitable for reduction in size and use in the operating manual system descriptions previously covered.

3.9 OPERATING AND MAINTENANCE TRAINING

A. The Electrical Contractor, and appropriate sub-contractors, shall provide comprehensive operating and maintenance instruction on building systems prior to delivery. The instruction shall include classroom instruction delivered by competent instructors based upon the contents of the operating manual. Emphasis shall be placed upon overall systems diagrams and descriptions, and why systems were designed as they were. The classroom instruction shall also include detailed equipment instruction by qualified manufacturer representatives for which operating instructions are provided. The manufacturer representative training shall emphasize operating instructions, and preventive maintenance as described in the operating manual. At a minimum, the training sessions shall cover the following items:
   1. Types of installed systems
   2. Theory of operation
      a) Design intent
      b) Occupied vs. unoccupied or partial occupancy
      c) Seasonal modes of operation
      d) Emergency conditions, transfer schemes, and procedures
      e) Other issues important to facility operation
   3. System operations
   4. Service, maintenance, diagnostics, and repair
   5. Use of reports and logs
   6. Troubleshooting, investigation of malfunctions, and determining reasons for the problem

B. Each classroom training period shall be followed by an inspection, explanation and demonstration of the system concerned by the instructors. All equipment listed in 3.07 A shall be started up and shut down, with the exception of sprinkler systems.

C. The contractor shall be responsible for organizing, arranging, and delivering this instruction in an efficient and effective manner on a schedule agreeable to the University.

D. The contractor shall provide, at or before substantial completion, a proposed agenda and schedule of the above training for approval by the Commissioning Authority and the University.

END OF SECTION

SECTION 26 09 33 DIMMING SYSTEM

PART 1 - GENERAL

1.1 Conform with applicable provisions of the General Conditions, Special Conditions and General Requirements.

1.2 RELATED WORK IN OTHER SECTIONS:

25 30 00	CONTROLS AND INSTRUMENTATION
26 05 00	GENERAL ELECTRICAL PROVISIONS
26 05 33	RACEWAYS, BOXES, AND FITTINGS

1.3 REQUIREMENTS: Furnish all labor, material, service, equipment, and appliances, etc., required to complete the installation of the Dimming System in accordance with the specifications and as indicated in the drawings.

1.4 Furnish and install a Dimming System as covered by these specifications to be wired, connected, and left in a first-class operating condition. The catalog number specified in the following are those of Lutron Electronics, Inc., and constitute the type and quality to be considered.

A. The contractor shall furnish, install, and connect complete lighting and dimming control systems including dimming, cabinets, control stations and all lighting equipment as described herein and shown on drawings.

B. All equipment shall be of the first-class quality and workmanship and of the latest manufacturer's design. All equipment shall bear the Underwriters' Laboratories seal of acceptance where applicable and shall be built to latest UL standards.

C. The entire system shall be completely factory tested under full load conditions prior to shipment. A full guarantee against defective parts and workmanship for one calendar year from the formal date of acceptance shall be required.

D. The manufacturer shall furnish at completion of installation of all dimming panels, fixtures and interconnecting wiring, a factory service engineer to perform initial start-up of the system, along with final adjustment of controls. Provide operation and maintenance instructions to the owner. Provision of the foregoing is considered part of the project and the cost shall be included in the bid.

E. Complete sets of shop drawings shall be submitted to the architect/engineer for his approval. No work shall begin on fabrication of the equipment until the drawings are approved and returned to the manufacturer.

F. Three instruction manuals, including system drawings, must be turned over to the owner upon approval of the system.

1.5 MEETING ROOM DIMMING SYSTEM FUNCTIONS:

A. General: Three separate and distinct dimming systems shall be provided. Each of the dimming systems shall function to provide independent lighting control for each partitioned area, or when areas are combined, lighting in these areas can be controlled simultaneously from one single control station.

B. System No. 1 controls lighting in five individual areas. System No. 2 controls lighting in four individual areas, and System No. 3 controls lighting in two individual areas.

C. Each system shall control three zones of lighting. Zone No. 1, incandescent lamps in the chandelier, to be dimmed; zone No. 2, incandescent lamps in recessed downlights, to be dimmed; and zone No. 3, mercury vapor lamps in recessed downlights, to be dimmed. Refer to the drawings for layout and number required.

D. Each system shall basically consist of three types of components:
   1. Assignment Control Panel (ACP): Shall function to assign control of lighting. Assignment shall be dictated by areas defined by operable partitions.
      a) The ACP shall have a graphic display to aid in coordination of lighting control assignment and area partitioning. It shall depict the entire area, showing all walls, partitions, and control station locations.
      b) The ACP shall be provided with transfer switches which shall provide the control of lighting transfer within the defined spaces. Transfer switch assignment shall be made possible in such a manner as to assure that all functional subdivisions and combinations of subdivisions shall be easily programmed by the user.
      c) Control status for each local control station shall be placed on the graphic display at its respective controller location. The control status shall indicate the active or inactive status of a given local control station, which shall take the form of a green solid-state LED.

d) All components necessary to perform the above functions shall be recessed inside a surface mounted NEMA grade enclosure with a lockable hinged cover, properly primed and painted with operating instructions permanently fixed to the rear of the enclosure door.

2. Local Control Stations: Shall be installed in each area as indicated on the drawings, and shall provide the following functions:
   a) Shall have a momentary switch for "Take Command/On and Off" functions, with red solid state LED indicator lamp. Shall have three linear slide controls providing manual control of three respective dimmed lighting zones.
   b) A green solid-state LED shall be located on the control to indicate the active or inactive status of the local control station as dictated by the master control console.
3. Dimming Panels:
   a) Incandescent dimmers shall be rated 2.5 KW maximum load for 120 Volt service. Cabinet enclosure shall be NEMA grade steel designed for surface mounting and shall contain all contactors, low voltage transformers, plug-in modules, dust-tight relays, circuit breakers, and other devices required to make a complete system. Any dimmer containing gaseous discharge tubes, vacuum tubes, or germanium semi-conductor devices will not be acceptable. Refer to drawings for number and location.

E. Portable Control Station: Provide two portable control stations for System No. 1. Refer to the drawing for locations. The portable control station shall provide the following functions:
   1. Manual slides for dimmed zones: Shall have a momentary switch for "Take Command/On and Off" functions, with red solid state LED indicator lamp. Shall have three linear slide controls providing manual control of three respective dimmed lighting zones.
   2. A green solid-state LED shall be located on the control to indicate the active or inactive status of the remote-control station as dictated by the ACP.
   3. A portable control station shall be supplied with a prewired jack and 100' of cable to be connected to a wall jack provided with the local control station.

PART 2 - PRODUCTS

2.1 GENERAL: Equipment shall be furnished based on system description and as otherwise indicated herein:

A. Assignment Control Panel:
   1. System No. 1 - Lutron No. ACP-5
   2. System No. 2 - Lutron No. ACP-4
   3. System No. 3 - Lutron No. ACP-2

B. Control Stations: For all areas, Lutron No. SVS-3B

C. Dimming Panels: For all Areas:
   1. Incandescent - Lutron No. 362-054
   2. Mercury Vapor - Lutron No. 362-044

2.2 The above description of the dimming system constitutes the intent of function to be provided. Equipment of similar and equal quality will be considered upon determination of compliance with specifications. Submit to the architect/engineer complete equivalent equipment specifications to be substituted 10 days prior to bid. Refer to "Wiring" below.

PART 3 - EXECUTION

3.1 WIRING: The contractor shall furnish and install in accordance with the manufacturer's instructions all wiring, conduit and outlet boxes required for the erection of a complete system as described herein and as shown on the drawings. All wiring shall be in conduit. All low voltage (24V) control wiring, conductor size and number shall be installed according to manufacturer’s wiring diagrams and recommendations. The drawings indicate wiring for one manufacturer; if another manufacturer's equipment is installed, the contractor shall make all necessary changes to the system without any additional charges after the contract has been awarded.

3.2 GUARANTEE: The contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for a period of one year from the date of installation.

3.3 The manufacturer shall furnish gratis to the owner a one-year contract effective from the date of installation for maintenance and inspection of the manufacturer's equipment, with a minimum of two inspections during the contract year.

END OF SECTION

SECTION 26 22 00 LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install transformers complete with all necessary appurtenances to perform the voltage transformation as required.

1.3 SUBMITTALS

A. Submit complete shop drawings with outline dimensions, wiring diagrams, catalog cuts and descriptive literature, including no load loss, total loss, regulation at 100% and 80% power factor, and net weight. If requested by the Engineer, submit production line impulse test reports.

1.4 RELATED WORK IN OTHER SECTIONS

A. Site work, services.

PART 2 - PRODUCTS

2.1 DRY TYPE TRANSFORMERS

A. General: Sizes and characteristics as shown on drawings. Unless otherwise specified, the design, manufacture and testing of dry type transformers and the methods of conducting tests and preparing reports shall be in accordance with NEMA Standard Publication for Specialty Transformers, No. ST1-4 (USASI-089). Provide separate primary and secondary windings for each phase (except where buck-boost auto transformers are indicated on the drawings) with industry standard voltage taps. All windings shall be copper. Provide with a suitable terminal compartment. The terminal compartment temperature shall not exceed 75 degrees C. when the transformer is operating continuously at rated load with ambient temperature of 40 degrees C.

B. Insulation: Class H insulation shall be rated for continuous operation of KVA with a temperature rise of not over 115 degrees C. above a 40-degree C. ambient and with a maximum hot spot temperature of 220 degrees C.

C. Enclosures: Ventilated for air cooling. Single phase transformers larger than 25 KVA and three phase transformers larger than 15 KVA shall be in a heavy gauge, sheet steel enclosures. Ventilation openings shall be of the mechanical maze type designed to prevent direct access to live parts in accordance with U.L., NEMA and National Electrical Code requirements for ventilated enclosures. Transformers smaller than the above shall be fully enclosed, in steel enclosures, with or without compound fill, or shall have exposed cores, impregnated windings and steel enclosures enclosing all live parts.

D. Sound Rating: Noise levels, determined in accordance with NEMA standards for Specialty Transformers, shall not exceed the following: 40db less than 50 KVa, 45db 51-150 KVA, 50db 151-300 KVA.

E. Manufacturers: General Electric, Hevi-Duty, Westinghouse or Sorgel. If requested, the transformer manufacturer shall furnish written certification that all dry type transformers furnished are constructed and tested in accordance with the standards referenced herein.

F. Mounting: Unless otherwise indicated on the drawings, dry type transformers having ratings not exceeding 45 KVA shall be suitable for wall mounting. Shop drawings of wall brackets and platforms for transformers having ratings exceeding 30 KVA shall be submitted for approval. All floor mounted transformers shall be provided with a 4” high 3000 psi concrete housekeeping pad.

G. Noise Suppression: Mount on approved vibration and noise vibration and noise isolating and damping supports. Conduit connections to transformers shall be made with sealtight flexible metal conduit, not less than 18 inches nor more than 36 inches in length.

2.2 GROUNDING

A. The materials, equipment, and devices related to the grounding system are specified under other sections of these specifications.

PART 3 - EXECUTION

3.1 SEPARATELY DERIVED SYSTEMS

A. Transformers creating separately derived distribution systems such as dry type transformers shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground. The size of grounding conductor from the transformer to the main equipment ground shall be determined by considering the transformer secondary as a service.

3.2 TESTING

A. The Contractor shall test the complete grounding system with a megger at the service ground bar and shall submit a written report to the Engineer for approval. The service shall not be energized if the test shows more than 5 ohms, unless approved by the Architect.

3.3 GROUNDING CONNECTIONS

A. Clean surfaces thoroughly before applying ground lugs or clamps. If the surface is coated, the paint, enamel or lacquer must be removed. Where galvanizing is removed from metal, it shall be painted or touched up with "Galvanox."

3.4 IDENTIFICATION

A. Provide an engraved micarta label on front of the tank indicating the transformer power source and the panel fed by the transformer.

END OF SECTION

SECTION 26 24 13 SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Service and distribution switchboards rated 600 V and less.
2. Surge suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

B. Related Sections include the following:
1. Division 26 Section "Surge Protective Devices for Low-Voltage Electrical Power Circuits" for transient voltage surge suppressors for low-voltage power, control, and communication equipment located in the switchgear.
2. Division 26 Section "Low Voltage Electrical Power Conductors and Cables".
3. Division 26 Section "Grounding and Bonding for Electrical Systems".

1.3 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, surge suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.
1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detailed short-circuits current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
8. Include diagram and details of proposed mimic bus.
9. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:
1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition, include the following:
1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
4. Circuit directories with load descriptions in electronic format.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Six of each type and rating used. Include spares for potential transformer fuses and control power fuses.
   2. Indicating Lights: Two of each size and type.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by UL and marked for intended location and application.

C. Use of series rated equipment is prohibited.

D. Comply with NEMA PB 2.

E. Comply with NFPA 70.

F. Comply with UL 891.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.9 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:
   1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a) Ambient Temperature: Not exceeding 104 deg F (40 deg C).
      b) Altitude: Not exceeding 6600 feet (2000 m).

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet (2000 m).

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards, including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.10 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: **Six** years from date of Beneficial Occupancy.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Corp. Electrical Group.
   2. Siemens Industry Inc.
   3. Gus Berthold Electric.

B. Front-Connected, Front-Accessible Switchboards:
   1. Main Devices: **Fixed, individually mounted, *insulated case.***
   2. Branch Devices: Panel mounted.
   3. Sections front and rear aligned.

C. Nominal System Voltage: [**480Y/277 V**] [**208Y/120 V**].

D. Main-Bus Continuous: refer to drawings

E. Factory certified 30 cycle rating.

F. Indoor Enclosures: 12-gauge Steel, NEMA 250, and Type 1.

G. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

H. Barriers: Between adjacent switchboard sections.

I. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

J. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

K. Rear Accessible Switchboards: Hinged Rear Doors and Compartment Covers to allow access to rear interior of Switchboard with Corbin #4T3142 key lock as approved by NU Electric Shop. Lock type shall be the same for both campuses.

L. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments, held with knurled thumb screw retainers.

M. Provide IR scanning windows in switchboard dead front to allow scan of line and load side lugs, and bolted connections.

N. Buses and Connections: Three-phase, four-wire unless otherwise indicated.
   1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated copper feeder circuit-breaker line connections.
   2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position, plug-in, finger type bus connections are not acceptable.
   3. Make all bus connections using a minimum of two (2) Grade 5 bolts with conical washers.
   4. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) hard-drawn copper of 98 percent conductivity, equipped with mechanica**l** connectors for feeder and branch-circuit ground conductors.
   5. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
   6. Neutral Buses: Tin-plated, 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables.
   7. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

O. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Surge Protection Device Description: IEEE C62.41-compliant externally mounted, UL 1449 3rd edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:
   1. Comply with Division 26 Section “Surge Protective Devices”.
   2. Provide a dedicated three pole circuit breaker for the SPD in the switchboard.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Corp. Electrical Group.
   2. Siemens Industry Inc.
   3. Gus Berthold Electric with Eaton Corp. or Siemens Industry Inc. components

B. Molded-Case Circuit Breaker (MCCB) Up To 1600 A: Comply with UL 489, fully rated to meet available fault currents. Use of series rated equipment is prohibited.
   1. Circuit breakers 600 Amps and greater shall be insulated molded case.
   2. Minimum frame size shall be 400 Amps for feeders and 800 Amps for Mains or Tie.
   3. Circuit breakers 400 Amps and greater shall be rated to carry 100% of nameplate rating continuously.
   4. Thermal-Magnetic Circuit Breaker Trips Less Than 225 A: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
   5. Electronic trip circuit breakers 225 A and larger shall have RMS sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
      a) Instantaneous trip.
      b) Long- and short-time pickup levels.
      c) Long- and short-time time adjustments.
      d) Ground-fault pickup level, time delay, and I2t response.
   6. Molded-Case Circuit-Breaker (MCCB) Features and Options:
      a) Standard frame sizes, trip ratings, and number of poles.
      b) Lugs: Mechanical style, rated Copper only, suitable for number, size, and trip ratings.
      c) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
      d) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide for source breakers for Closed Transition Transfer Switches.
      e) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 CIRCUIT BREAKERS – MAIN DEVICES 1600A THROUGH 2000A

A. Description: Comply with IEEE C37.13 and .16 and UL 1066.
   1. Eaton “Magnum SB” or equal by Siemens, draw out type insulated case power circuit breaker.

B. Ratings: As indicated, fully rated, for continuous, interrupting, and short-time current ratings for each circuit breaker; voltage and frequency ratings same as switchgear.
   1. Minimum frame size shall be 1600 A.

C. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:
   1. Normal Closing Speed: Independent of both control and operator.
   2. Slow Closing Speed: Optional with operator for inspection and adjustment.
   3. Operation counter.

D. Trip Devices: Solid-state, overcurrent trip-device system consisting of one or two current transformers or sensors per phase, a release mechanism, and the following features:
   1. Eaton “Digi-Trip 1150” plus or equal.
   2. Functions: Long-time-delay, short-time-delay, and instantaneous-trip functions, independent of each other in both action and adjustment.
   3. Temperature Compensation: Ensures accuracy and calibration stability from minus 5 to plus 40 deg C.
   4. Field-adjustable, time-current characteristics.
   5. Current Adjustability: Dial settings and rating plugs on trip units or sensors on circuit breakers, or a combination of these methods.
   6. Three bands, minimum, for long-time- and short-time-delay functions; marked "minimum," "intermediate," and "maximum."

7. Pickup Points: Five minimum, for long-time- and short-time-trip functions. Equip short-time-trip function for switchable I2t operation.
8. Pickup Points: Five minimum, for instantaneous-trip functions.
9. Ground-fault protection with at least three short-time-delay settings and three trip-time-delay bands; adjustable current pickup. Arrange to provide protection for the following:
   a) Three-wire circuit or system.
   b) Four-wire circuit or system.
   c) Four-wire, double-ended substation.
10. Trip Indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.
11. Maintenance mode switched trip units: The trip unit shall utilize Arc Flash Reduction Maintenance System (ARMS) to reduce the instantaneous pickup value when activated. The ARMS shall provide a clearing time of 0.04 seconds with a minimum of settings from 2.5X to 10X of the sensor value. The ARMS shall be enabled by a switch on the trip unit with blue indicator LED. A remote communication link shall also be provided for enable/disable and confirmation.

E. Padlocking Provisions: For installing at least three padlocks on each circuit breaker to secure its enclosure and prevent movement of drawout mechanism. Provisions shall be included for padlocking the breaker in the open or closed position.

F. Operating Handle: One for each circuit breaker capable of manual operation.

G. Electric Close Button: One for each electrically operated circuit breaker.

H. Mechanical Interlocking of Circuit Breakers: Uses a mechanical tripping lever or equivalent design and electrical interlocks.

I. Undervoltage Trip Devices: Where indicated, adjustable time-delay and pickup voltage.

J. Shunt-Trip Devices: Where indicated.

K. Indicating Lights: To indicate circuit breaker is open or closed, for main and bus tie circuit breakers interlocked either with each other or with external devices.

L. Lugs: Mechanical style, rated for Copper conductors only, suitable for number, size, and trip ratings.

M. Grounding Ball Studs: provide on incoming lug pad and outgoing lug pad.

N. Provide fused shorting blocks for maintenance.

2.5 INSTRUMENTATION

A. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks. Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks. Meters are described in Division 26 Section “Electricity Metering”.

B. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
   1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
   2. Current Transformers: IEEE C57.13; 5 Amp, 60 Hz, secondary and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
   3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
   4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

C. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for four-wire systems and with the following features:
   1. Comply with Section 26 2713 “Electricity Metering” requirements.
   2. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
   3. Selectable digital display of the following values with maximum accuracy tolerances as indicated:

a) Accuracy: Power meter shall meet ANSI C12.20 for Class 2 and IEC 62053-22 accuracy requirements.
b) Phase Currents, Each Phase.
c) Phase-to-Phase Voltages, Three-Phase.
d) Phase-to-Neutral Voltages, Three-Phase.
e) Three-Phase Real Power.
f) Three-Phase Reactive Power.
g) Power Factor.
h) Frequency.
i) Power demand shall be simultaneously calculated using five different averaging methods: Fixed Window (Block) Average, Sliding Window (Rolling Block) Average, Thermal Average, Predicted Average, and Cumulative Demand. Values for all averaging intervals must be available simultaneously.
j) Accumulated Watt-hr, VA-hr, and VAR-hr; Watt-hr received; Watt-hr delivered.
k) Contact devices to operate remote impulse-totalizing demand meter.

4. Mounting: Display and control unit flush or semi-flush mounted in instrument compartment door.

2.6 NETWORK COMMUNICATIONS

A. The manufacturer shall wire between all communications' capable devices within the switchboard, including electronic meters with the same protocol and wire to a set of easily accessible terminal blocks.

2.7 CONTROL POWER

A. Control Circuits: 120-VAC, supplied through secondary disconnecting devices from control-power transformer.

B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.8 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

2.9 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on an engraved laminated-plastic nameplate.

B. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

C. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components complete with lettered designations.

D. Service Equipment Label: UL labeled for use as service equipment where required.

E. Each vertical section is to be labeled with the vertical bus voltage, amperage, phase, and fault current bracing rating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged. Scratches and small dents shall be repaired as approved by NU Chief Electrician.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete bases, 4-inch (100-mm) nominal thickness (Evanston: 6” east of Sheridan Rd.). Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchboards unless otherwise indicated. Comply with requirements specified in Division 03 Concrete Sections.
   1. Install dowel rods to connect concrete base to concrete floor on 18-inch (450-mm) centers around the full perimeter of concrete base.
   2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor, install to elevations required for proper attachment to switchboards.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Provide wall mounted cabinet with lockable hinged door, to store all accessories, test equipment, small spares, operating and maintenance manuals, and maintenance ledger in same room as equipment.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

H. Install externally mounted Surge Protection Devices. Lead length not to exceed 36 inches.

I. Verify tightness and torque all accessible bolted electrical connections to manufacturer’s specified values using a calibrated torque wrench.

J. Double lugging on one protective device to feed two (2) separate loads is not permitted.

K. Comply with NECA 1.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding."

B. Connect wiring according to Division 26 Section "Low Voltage Conductors."

C. Verify tightness and torque all accessible bolted electrical connections to manufacturer’s specified values using a calibrated torque wrench. Provide a list of all torqued connections and values.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Arc Flash Labels: provide as specified in Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.
   3. Submit to Owner.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Perform the following infrared scan tests and inspections and prepare reports:
      a) Initial Infrared Scanning: After Substantial Completion, but not more than 90 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front and rear panels so joints and connections are accessible to portable scanner.
      b) Instruments and Equipment:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
      c) Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchgear line-up 11 months after date of Substantial Completion.
   4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
   5. Submit reports to Owner.

D. Switchboard will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection report, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.6 CLEANING

A. Vacuum dirt and debris from switchboard compartments; do not use compressed air to assist in cleaning.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in the "Overcurrent Protective Device Coordination Study." Provide list of “as left” settings and submit to Electric Shop.

END OF SECTION

SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section

1.2 DESCRIPTION OF WORK

A. Furnish and install complete, all panelboards.

1.3 RELATED WORK IN OTHER SECTIONS

A. Cabinets; Motor & Circuit Disconnects; Fuses; Service and Distribution; Grounding; Conductors, Raceways, Boxes and Fittings.

1.4 SUBMITTALS

A. Submit complete shop drawings with outline dimensions, descriptive literature and complete descriptions of the frame size, trip setting, class, and interrupting rating of all overcurrent devices. Identify available spaces. Complete description of physical layout of panelboards showing conformance with drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Dead front, safety type, with voltage and amperage ratings as scheduled. Panelboards shall be of the type required for the short circuit and duty ratings indicated on the drawings or specified. All panelboards shall have a neutral bus and an insulated ground bus. Panelboards shall be as manufactured by General Electric, Cutler-Hammer or Square D and shall be as scheduled.

2.2 CABINETS

A. Each panelboard shall be enclosed in a sheet metal cabinet with front doors, catches, locks, etc., as specified in Section 262716, Cabinets.

B. Door-in-Door: Both surface and flush panels shall be door-in-door. The door over the interior of the panel shall be provided with hinges and combined lock and latch. The outside door over the panel gutters shall be provided with hinge(s) on one side and combined lock and latch. Machine screws into threaded holes in the panelboard cabinet, in lieu of combined lock and latch, to secure the outside door are not acceptable.

2.3 CIRCUIT BREAKER PANELBOARDS

A. Panelboard interiors shall be constructed on pre-drilled and tapped channel rails. Main busses shall be pre-drilled and tapped to accommodate any combination of circuit breaker units without further modification. All panelboards shall be complete with doors. Units shall be complete with combination latch and cylinder locks. All locks shall be keyed alike. All bussing shall be of the "sequence type". All connections shall be bolted.

B. Circuit breakers shall be molded case type (minimum 10,000-amp interrupting capacity, larger as required). All multi-pole breakers shall have a common trip and all breakers shall be interchangeable in any combination of poles with the same frame size. All branch circuit straps shall have the capacity of the maximum breaker size in the frame space (i.e., 100-amp strap for 100-amp frame). Minimum 100-amp straps will be accepted.

C. All main and branch breakers shall be of the size and have the interrupting rating scheduled on the Drawings. All incoming and outgoing terminals shall have solderless lugs. Provide, where required, lug landing to accommodate number and size conductors shown on the Power Riser. Panelboards shall be factory assembled.

D. Single pole circuit breakers shall be suitable for switching duty and marked "SWD".

E. Bolted Type: Circuit breaker current carrying connections to the bus shall be of the bolted type, factory assembled. Stab in type not permitted. Provide bus bars for three phase panelboards of the sequence phased type connection and arranged for 3 phase, 4 wire mains, unless otherwise indicated on the drawings.

F. Space Only: Where "space only" is noted on the drawings, provide necessary connectors, mounting brackets, etc., for the future insertion of an overcurrent device. Provide blank cover for each space.

G. Directories: Provide typewritten circuit descriptions referencing permanent room numbering assigned in lieu of the room numbering shown on the drawings.

H. Spare Conduit: Provide three spare 1" conduits for each panel. Extend empty conduit with pullwire into accessible ceiling space and stub-out for future use.

2.4 NAMEPLATE

A. Labels for identifying the breakers shall be engraved laminated plastic strips attached by screws (see "Nameplates" Specifications in Section 260500) or labels supplied by Panel Manufacturer.

B. Nameplates on Panelboards shall give voltage characteristics phase and number of wires. Example: Panel A, 120/208V, 3 phase, 4W.

C. Individual circuit breakers or switches, panelboards, disconnect means and motor starters shall have nameplate showing the load served.

D. Blank name plates shall be mounted on each "spare" unit or on "space" in distribution panels.

2.5 SKIRTS

A. Where noted on the drawings, panelboards shall be skirted with complete metal enclosures and barriers separating the panel interior.

2.6 BUS BARS

A. All bus bars shall be copper. Use of aluminum bus bars will not be permitted.

2.7 CONNECTORS AND LUGS

A. Contractor shall review one-line and other Drawings to assure that proper lugs are provided in termination equipment such as switches, panels, switchboards, mechanical equipment, etc. Due to voltage drop conductor sizes and/or numbers may not be accommodated by the equipment affected. If manufacturer cannot provide the proper number and size of lugs within their equipment the Contractor shall provide enclosures and properly sized terminals to convert the oversized cable, number and size that is compatible to the equipment affected.

PART 3 - EXECUTION

3.1 PANELBOARDS

A. Panelboards shall be located where indicated on the drawings. Panelboards shall have neatly typed circuit directories behind clear plastic. Identify circuits by area designations and use. "Spare" and "Space" shall be indicated with erasable pencil, not typed.

B. Circuiting of all branch circuits shall be as designated on the drawings. Breaker and switch arrangement in panels shall be exactly as specified and all circuits will terminate in the positions indicated.

3.2 PHASE ROTATION

A. Phase A, left bus; phase B, center bus; phase C, right bus (front viewing).

END OF SECTION

SECTION 26 27 16 CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install cabinets for panelboards, telephone, and communication systems as required.

1.3 RELATED WORK IN OTHER SECTIONS

A. Panelboards, sound systems, telephone systems.

PART 2 - PRODUCTS

2.1 GENERAL

A. Sheet steel code gauge, galvanized cabinets with painted fronts and trim. Those exposed to wet or rain conditions shall be "raintight" unless otherwise noted. Cabinets without through feeder wiring shall be arranged to provide a wiring gutter not less than 4 inches wide for branch circuit panelboards served by feeders up to 4/0. Panelboards served by feeders in excess of 4/0, up to and including 750 kcmil, shall be provided with top, bottom, and side gutters 8 inches wide. Cabinets shall be of standard make and shall bear the Underwriters Laboratories label. All outside surfaces of trim and doors shall be given a factory finish coat of No. 61 ANSI gray paint, or approved manufacturer's standard. Cabinets for telephone and communications systems shall have 5/8-inch exterior grade, one-face B-grade or equal flame proofed plywood backboard inside with maximum height and width.

2.2 FEED-THROUGH GUTTERS

A. Where feeders go through panelboard cabinets to serve panelboards above or beyond, the wiring gutters in panelboard cabinets shall be a minimum of 8 inches on sides, top and bottom.

2.3 TRIM

A. One-piece, sheet steel trim with hinged door with catch and lock. One piece sheet steel with 3/4 inch flange around all edges shaped to cover edge of box. For telephone or communication cabinets trims with captive nuts or clamps. Trims shall be furnished with indicating adjustable trim clamps for panelboards.

2.4 DOORS

A. Doors shall close against a rabbet placed all around the inside edge of the frame with a close fitting joint between door and frame. The doors shall be fitted with substantial flush hinges placed not over 24 inches apart, nor more than six inches from ends of doors, and fastened permanently to the door and frame with round-headed rivets or spot welds, or with concealed flush piano hinges. Fastening screws or clamps or trims shall be set not over 24 inches apart. Doors over 48 inches in height shall be equipped with a vault handle and a three-point catch.

2.5 LOCKS

A. Furnish each cabinet with a combination catch and flat key lock. The telephone, electrical and signal cabinet locks shall be fitted to separate keying for each system. Furnish two keys for each cabinet.

2.6 GROUND BAR

A. Each cabinet, for a panelboard, shall be provided with a copper interior ground bar suitably braced or bolted to the cabinet wall. The equipment ground bar shall be equivalent in current carrying capacity to the incoming feeder ground conductor and shall have approved pressure connector terminations for the associated feeders, branch circuits, etc.

PART 3 - EXECUTION

3.1 CABINETS

A. Cables installed in the wiring gutters of cabinets shall be neatly bundled, routed, and supported. Minimum bending radii as recommended by the cable manufacturer shall not be reduced. Lighting and power cabinets shall be installed with tops 6'-6" above floor and bottoms not less than 12 inches above floor.

END OF SECTION

SECTION 26 27 26 WIRING DEVICES AND PLATES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions for the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install all wiring devices and plates as required for the complete installation and operation of all systems throughout the project.

1.3 RELATED WORK IN OTHER SECTIONS

A. Conductors, Conduit, Boxes and Fittings.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Unless otherwise specified, each wall switch (flush tumbler-toggle) shall be of the A.C. General use type for mounting in a single gang spacing, fully rated 20 amperes minimum at 120/277 volts, conforming to minimum requirements of the latest revision of the Underwriter's Laboratories, Inc., UL 20 Fifth Edition Standard Snap Switches and further requirements herein specified. Specification grade, heavy duty, single pole, 3-way or 4-way, of the maintained, momentary or lock type as indicated on the drawings. Switches shall operate in any position and shall be fully enclosed cup type with entire body of molded phenolic, urea or melamine with cover of molded phenolic, urea or melamine. Fiber, paper, or similar insulating material shall not be used for body or cover. Ivory color handles unless otherwise indicated. Silver or silver alloy contacts. A.C. 120/277 volt general use snap switches shall be capable of withstanding tests as outlined in NEMA Publications and shall be as follows unless otherwise noted:

Switch	Hubbell	P & S	Bryant	Leviton
1P	1221-I	20-AC-1-I	4901-I	1221-I
2P	1222-1	20-AC-2-I	4902-I	1222-I
3-Way	1223-I	20-AC-3-I	4903-I	1223-I
4-Way	1224-I	20-AC-4-I	4904-I	1224-I
3-pos. 2 cct maintained	1385-I	1225-I	4922-I	
3-pos. 2 cct momentary	1557-I	1251-I	4921-I	
Lighted handle pilot lgt.	1221-PL	2251-SP	4901-PL	1220-PL

2.2 RECEPTACLES

A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publications. Fire resistant, non absorptive, hot welded, phenolic composition or equal bodies and bases with metal plaster ears (integral with the supporting member). Single or duplex as shown or noted on drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong.

B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper (based on Table 250-95 of the NEC with minimum size No. 14 AWG). Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke. Unless otherwise noted, receptacles shall be as follows:

Receptacle	Hubbell	P & S	Bryant
20A-125V AC 2P 3W	5362-I	6300-I	5362-I
20A-208V AC 4P 4W	7250	7250	7250
30A-250V AC 3P 3W	9350	L1030R	9303
30A-600V AC 4P 4W	3430	3430	3430
Special	Receptacles for special applications shall be as indicated on the drawings.		

C. Load Controllable Type:
   1. Meet all aspects already detailed in specifications.
   2. Permanent controlled markings on face of receptacle compliant with ASHRAE 90.1, CA Title 24, and NEC.
   3. Half-controlled versions include welded, pre-wired lead that control top half of receptacle for split circuit applications.
   4. Refer to plans for specific model and control options.

2.3 PLUG CAPS

A. Except for duplex receptacles, and cleaning combination receptacles one matching plug cap shall be provided for each receptacle. No plug caps are required for duplex receptacles. Provide watertight, male plug caps in damp locations or where exposed to weather.

2.4 DEVICE PLATES

A. General: Provide plates for each switch, receptacle, signal and telephone outlet and special purpose outlet. Do not use sectional gang plates. Provide multi gang outlet plates for multi gang boxes. All plates on finished walls shall be Leviton #84000-40 series, stainless steel. Screws shall be of metal with countersunk heads with finish to match the finish of the plate. Device plates shall be of the one-piece type, of suitable shape for the device to be covered.
B. Exposed: Plates for exposed screw jointed fittings shall match the fittings with edges of plates flush with edges of fittings. To be heavy cadmium plates, steel, with gasket. Plates for cast type boxes at locations subject to wet or rain conditions, shall be of the cast, vapor tight type. Provide hinged lift covers for devices.
C. Communications: Plates for telephone and signal outlets shall each have a 3/8-inch bushed opening in the center. Wall plates for push button and buzzer outlets shall have openings to suit the push buttons and buzzers.
D. Plates for special purpose outlets shall be of a design suitable for the particular application.

2.5 CLOCK OUTLETS

A. Flush, single receptacle, regressed in stainless steel device plat.

2.6 REMOTELY CONTROLLED SWITCHES OR RELAYS

A. Electro-magnetically operated, mechanically held with clearing contacts for maintained contact control unless otherwise required. Rugged construction conforming to NEMA and IEEE test standards for industrial type power relays and the requirements of UL 508, Standards for Safety Industrial Control Equipment. Ratings as indicated on the drawings suitable for the application. Contacts shall be double break renewable, solid wiping type, silver-to-silver Tungsten alloy, self-aligning, quick-make, quick-break, with a minimum inductive load rating of 20 amps. Relays shall be as manufactured by Allen-Bradley, Cutler-Hammer, General Electric, Square D or Westinghouse, equal to Allen-Bradley Bulletin 700 Control Relays. Provide sound deadening mounting and enclosure.

2.7 MOMENTARY CONTACT SWITCHES

A. Tumbler type single pole double throw momentary contact for 3 wire circuit, with Off position when tumbler handle is in the center, similar in appearance to the conventional snap switch. Handle or key operated as indicated on drawings. 15 ampere at 120/277 volts for control of 30, 60, or 100 ampere remotely controlled switches or relays rated 101 amperes and above. Provide nameplate to identify the circuit or equipment controlled.

PART 3 - EXECUTION

3.1 OUTLET LOCATIONS

A. Shall be as indicated on the drawings. Align devices and plates horizontally and vertically.

B. It shall be the responsibility of the Contractor to determine from the architectural drawings and by actual determination on the site, the exact location of each and every outlet. The outlet locations shall be modified from those shown on the plans to accommodate changes in door swings or to clear other interferences that may arise from job construction details as well as modifications within room spaces. These modifications shall be made with no change in contract price and shall be a matter of job coordination at the expense of the Contractor. The Contractor shall check these conditions throughout the entire job and shall notify the Architect/Engineer of discrepancies as they occur before proceeding with the installation of the work to verify the modifications, if any. Wall boxes shall be set in advance of wall construction, shall be blocked in place

and secured. All wall boxes shall be set flush with finished building construction and the Contractor shall furnish and install extension sleeves as required to extend boxes to the finished surfaces of special furring. No switches shall be located behind doors without specific written authorization by the Architect.

3.2 YOKES

A. Wiring device yokes shall be installed in physical contact with the plaster ring. Where the above contact cannot be obtained, a green covered bonding conductor shall be installed.

3.3 PLATES

A. Shall be installed with all four edges in continuous contact with finished wall surface without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed vertically and with an alignment tolerance of 1/16".

B. Device cover plates for each and every device shall be furnished and installed by this Contractor.

3.4 RECEPTACLES

A. Shall have a separate ground wire from the grounding screw to a grounding stud in the outlet box. All receptacles shall be installed with the "U" slot in the upper position. Substitutions for duplex convenience outlets as listed in 16140 - 2.2 shall only be considered if rated as “Specification Grade”.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 28 00 MOTOR AND CIRCUIT DISCONNECTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install complete motor and circuit disconnects for various items requiring them for this project.

1.3 RELATED WORK IN OTHER SECTIONS

A. Conductors, motors, motor starters, motor control centers, panelboards, grounding.

PART 2 - PRODUCTS

2.1 DISCONNECTING MEANS

A. Safety Switches: Fusible Type HD quick break safety switches of the sizes and capacities indicated or required. NEMA 4 Raintight enclosures at locations exposed to the weather.

B. Separately Enclosed Motor Snap Switches: Motor snap switches may be used for motor disconnect means, controller, and motor overcurrent protection when applicable. These devices shall be horsepower rated and shall contain motor running overcurrent protection.

2.2 SAFETY TYPE DISCONNECTING SWITCHES

A. Heavy duty, quick make, quick break type, 250, 480 or 600 volt rating as required for the application. Number of poles and ampacity as noted or required for application, or required by code. Fusible with fuse clips suitable for Buss fuses. Short circuit rating of 200,000 RMS Amperes with Class R rejection feature installed in fuseholders. NEMA 1 enclosures for dry locations. NEMA 4 enclosures for wet locations or where exposed to weather unless otherwise noted.

B. Fuses shall be provided for all switches. Fuses for switches at motors shall be Bussman Fusetrons, sized for heavy service motor running protection. Fuses in other locations shall be as designated on the drawings or indicated in Section 262813 of these specifications. Proper fuse amp ratings shall be indicated on inside of switch cover, through the use of "Tapewriter" and should read "Use Fusetrons Only" (indicate amperage size as shown on plans). See Section 262813 for other labeling requirements.

PART 3 - EXECUTION

3.1 DISCONNECT MEANS

A. Install in each location indicated on the drawings and elsewhere as required by NEC.

B. Switches installed outdoors shall be raintight and shall be suitably supported, independently of the item to be served (by unistrut rack) unless sufficient unobstructed flat surface exists on the unit to properly support the electrical equipment.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 28 13 FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish and install all fuses required for the various electrical systems required for this project.

1.3 RELATED WORK IN OTHER SECTIONS

A. Panelboards, motor control centers, motor and circuit disconnects.

PART 2 - PRODUCTS

2.1 FUSES

A. General: Dual element, time delay type, based on heavy service, Buss Fusetron, or equal, unless otherwise noted or required for installation. For individual motor circuit protection, provide fuse sized approximately 125 percent of full load current with 200,000 amperes interrupting capacity.

B. Current-Limiting Fuses: Provide where indicated on the drawings. For non-motor feeder protection in conjunction with fused switches, install NEMA Class L or K Buss Limitron fuses sized 125 percent of load current or as required for coordination with air and molded case circuit breakers.
   1. Above 600 amps: Class L, "Hi-Cap" as manufactured by Bussman.
   2. Below 600 amps, as required by short circuit duty, Class RK-1, "Limitron" or Class RK-1, "Low Peak" or Class RK-5, "Fusetron" as manufactured by Bussman.
   3. All switches having current limiting fuses installed shall have a Lamicoid nameplate with white lettering on red background reading:

WARNING, REPLACE ONLY WITH CURRENT
LIMITING FUSES AS ORIGINALLY INSTALLED

C. All fuses shall be rated 200,000 AIC and be of the rejection feature type.

2.2 COORDINATION

A. Coordinate the low voltage fuses required for the project to provide basic selective protection and properly coordinate with the other associated protective equipment.

2.3 FUSE CABINET

A. Provide one wall mounted cabinet for storing all spare fuses. The cabinet shall have a hinged door with latch, with the word "FUSES" stenciled on the front.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate the low voltage fuses required for the project to provide basic selective protection and properly coordinate with the other associated protective equipment.

3.2 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SPARE FUSES

A. Furnish one complete spare set (3) of each size and type of fuse required on this project for panelboards, safety switches, and switchboards. Deliver to Owner in the original boxes and store in the fuse cabinet furnished under this Contract.

END OF SECTION

SECTION 26 43 00 SURGE SUPPRESSION PROTECTION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General requirements for both type 1 and type 2 surge protective devices (SPDs) for the protection of electrical power circuits not exceeding 1000 V.

B. Type 1 surge protective devices (SPD's) for the protection of electrical power circuits not exceeding 1000 V.

C. SPDs for the protection of signal, data, antenna, and control lines.

1.2 SUBMITTALS

A. Submit the following:
1. Catalog Data: Submit catalog data describing SPDs. Include data substantiating that proposed products comply with specified requirements.
2. Installation Instructions: manufacturer's manual.
3. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
a) Test procedures used.
b) Test results that comply with requirements.
c) Failed test results and corrective action taken to achieve requirements.
4. Maintenance Data: For surge protective devices to include in maintenance manuals
5. Manufacturer's Warranty: Provide manufacturer's warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

1.3 QUALITY ASSURANCE

A. Comply with the *National Electrical Code* (NEC), and NFPA 780 – *Standard for the Installation of Lightning Protection Systems* for installation requirements, where applicable.

B. Provide SPDs that are listed by a Nationally Recognized Testing Laboratory (NRTL). Listing standard shall be the following, as applicable:
1. ANSI/UL 1449 – Standard for Safety for Surge Protective Devices.
2. UL 497B – Standard for Safety for Protectors for Data Communications and Fire Alarm Circuits.
3. UL 497C – Standard for Safety for Protectors for Coaxial Communications Circuits.

C. Provide SPDs suitable for use at a nominal altitude of 5,500 ft, or elevation commensurate with the project location.

1.4 Receiving, Storing and Protecting

A. Receive, store, protect, and handle products according to the manufacturer's instructions and NECA 1 *Standard Practices for Good Workmanship in Electrical Construction*.

1.5 COORDINATION

A. Coordinate location of field-mounted surge protective devices to allow adequate clearances for maintenance.

1.6 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge protective devices that fail in materials or workmanship within five years from date of Substantial Completion.

C. Special Warranty for Plug-in Cord-Connected Surge Suppressors: Written warranty, executed by manufacturer agreeing to repair or replace electronic equipment connected to circuits protected by surge protective devices.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted; Submit under provisions of Division 26 Section and Division 01 Section "General Requirements."

2.2 GENERAL SPD REQUIREMENTS FOR POWER APPLICATIONS

A. NRTL listed to UL 1449.

B. SPD shall provide surge current paths for at least the following modes of protection:
1. L-N, L-G, and N-G for wye-connected systems.
2. L-L, L-G in delta-connected systems.

C. Provide each individual SPD intended for mounting internal to the electrical assembly with a NEMA enclosure suitable for the installation location and environment.
1. NEMA 1, 12, 3R, and 4 enclosures: powder-coated steel.
2. NEMA 4X enclosures: polycarbonate or Type 304 stainless steel.

D. Each SPD shall pass the manufacturing and production line tests required in UL 1449 latest Edition.

2.3 Type 1 SPD

A. AC Power SPDs shall have a UL 1449 Short Circuit Current Rating (SCCR) not less than the following:

System Voltage	Circuit Size	Minimum Surge Current Capability
480Y/277	Any	200 kA
480 Delta	Any	200 kA
208Y/120	Greater than 400 A	200 kA
208Y/120	400 A and less	100 kA
120/240	Any	100 kA

B. SPD shall be suitable for use without external or supplemental overcurrent protection. Every suppression component of every mode shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary overcurrent protection will not be considered.

C. SPD shall have a UL 1449 nominal discharge current rating (I_n) of not less than 20 kA.

D. Suppression components shall be thermally-protected 32 mm or larger metal-oxide varistors (MOVs).

E. AC Power SPDs minimum surge current capability (single pulse rated) per phase shall be as indicated for the following applications:
1. Service Equipment:

System Voltage	Equipment Size	Minimum Surge Current Capability
480Y/277	Any	240 kA
480 (ungrounded)	Any	240 kA
208Y/120	Greater than 400 A	240 kA
208Y/120	400 A and less	100 kA
120/240	Any	100 kA

2. Panelboards and MCCs that supply one or more electrical circuits that leave the structure to supply another structure and the conductors extend more than 100 feet:

System Voltage	Minimum Surge Current Capability
480Y/277	150 kA
480 (ungrounded)	150 kA
208Y/120	100 kA
120/240	100 kA

3. Panelboards and MCCs that supply one or more electrical circuits that leave the structure to supply equipment that is exposed to lightning (e.g., roof mounted HVAC equipment, parking lot lighting):

System Voltage	Minimum Surge Current Capability
480Y/277	150 kA
480 (ungrounded)	150 kA
208Y/120	100 kA
120/240	100 kA

F. AC Power SPDs UL 1449 Voltage Protection Rating (VPR) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
480Y/277	1200V	1200V	2000V	1200V
480 (ungrounded)	--	1800V	2000V	--
208Y/120	700V	700V	1200V	700V
120/240	700V	800V	1200V	700V

G. UL 1449 Maximum Continuous Operating Voltage (MCOV) rating shall be not less than the following:

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
480Y/277	15%	320V
480 (ungrounded)	15%	550V
208Y/120	25%	150V
120/240	25%	150V

H. AC Power SPDs shall include not less than the following monitoring and diagnostic features that report the protection status of the SPD:
   1. One green LED (protected) indicator per phase and one red (not protected) LED.
   2. For SPDs with a surge current capacity greater than 100 kA provide an audible alarm with on/off silence function, and one set of NO/NC contacts that change state under any fault condition.

I. Where indicated on the Drawings or specified in other Sections, provide SPDs that are factory installed and integrated within the protected electrical switchboards.

J. Manufacturers:
   1. Advanced Protection Technologies:
      a) Surge Current Capability over 100 KA: “XAS” series,
      b) Surge Current Capability 100 KA or less: “XDS” series.
   2. Eaton:
      a) Surge Current Capability over 100 KA: “SPD” series,
      b) Surge Current Capability 100 KA or less: “CVX100” series.
   3. Siemens:
      a) Surge Current Capability over 100 KA: “TPS3 01,” TPS3 05”, “TPS3 06,” “TPS3 12.”
      b) Surge Current Capability 100 KA or less: “TPS3 11.”
   4. Square D:
      a) Surge Current Capability over 100 KA: “IMA” and “EMA” series,
      b) Surge Current Capability 100 KA or less: “IMA” and “EMA” series.
   5. Current Technology:
      a) Surge Current Capability over 100 KA: “SL3” and “TG3” series
      b) Surge Current Capability 100 KA or less: “SL3” and “TG3” series
   6. Other “prior approved” manufacturers

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify mounting area is ready for SPDs.

B. Verify that circuit rough-in is at correct location.

3.2 INSTALLATION

A. Install SPDs as specified below, according to the manufacturer's instructions, NFPA 780, and the *National Electrical Code*. The manufacturer’s installation instructions shall be available at the construction site.

B. Service Equipment:
   1. Install SPD that is factory installed and integrated into each low-voltage service equipment.
   2. Provide a means of connection for the SPD, as recommended by the manufacturer. This might be a sub-feed connection block, or it might by a dedicated circuit breaker.

C. Connect SPDs to protect each ungrounded (line) and grounded (neutral) conductor. Externally mounted SPD’s require full-size (100%) neutral and ground conductors.

D. Install each SPD so it will be accessible for inspection and maintenance.

E. Install SPDs in a manner that will not limit the use of through-feed lugs, sub-feed lugs, or sub-feeder circuit breakers in panelboards.

F. Install each SPD with conductor length according to the manufacturer’s instructions.
   1. Twist conductors tightly together and keep runs as straight as possible with no sharp bends or kinks.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.4 FIELD QUALITY CONTROL

A. Provide final protection and maintain conditions to ensure that coatings and finishes are without damage or deterioration at final inspection.

B. Repair damage to paint finishes with matching touch-up coating recommended by the manufacturer.

C. Verify that each SPD is correctly connected and that all condition monitoring indicators operate properly.

D. Verify mechanical integrity of each conductor connection

E. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
   1. Verify that electrical wiring installation complies with manufacturer's installation requirements.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain surge protective devices.
   1. Train owner’s maintenance personnel on procedures and schedules for maintaining surge protective devices.
   2. Review data in maintenance manuals.
   3. Schedule training with owner with at least ten days' advance notice.

END OF SECTION

SECTION 26 51 19 LED INTERIOR LIGHTING

PART 1 – GENERAL

1.1 Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

1.2 RELATED WORK IN OTHER SECIONS

26 05 00	GENERAL ELECTRICAL PROVISIONS
26 05 19	LOW VOLTAGE CONDUCTORS
26 05 26	GROUNDING
26 05 33	RACEWAYS, BOXES AND FITTINGS
26 27 26	WIRING DEVICES AND PLATES

1.3 SECTION INCLUDES:

A. Interior solid-state luminaires that use LED technology.

B. Lighting fixture supports.

C. Construction and installation requirements.

1.4 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See “Luminaire”.

D. IP: International Protection of Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.5 SUBMITTALS

A. Product Data: For each type of product, arranged by designation.

B. Product Schedule: For luminaires and lamps. Use same designation indicated on Drawings.

C. Refer to Section 260500 for additional requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Product Certificates: For each type of luminaire.

C. Sample warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 – PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Recessed Fixtures: Comply with NEMA LE 4.

C. CRI and CCT shall be as scheduled on contract documents.

D. Rated lamp life of 50,000 hours.

E. Lamps dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage: as specified on the drawings.

H. Housings:
1. Extruded-aluminum housing and heat sink.
2. Clear powder-coat finish.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.2 MATERIALS

A. Metal Parts:
1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Prismatic acrylic.
2. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:
1. Extruded-aluminum housing and heat sink.
2. Clear powder-coat finish.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 “Hangers and Supports for Electrical Systems” for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: ½-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports: Sized and rated for luminaire weight.

E. Flush-Mounted Luminaire Support: Secured to outlet box.

F. Ceiling-Mounted Luminaire Support:
1. Ceiling mount with two 5/32-inch-diameter aircraft cable supports adjustable to 120 inches in length. Brace to limit sway or swinging.

G. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging or sway.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Division 26 for Power Conductors and Cables for wiring connections.

J. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 for Identification for Electrical Systems.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare Test and inspection reports.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 26 60 00 MECHANICAL AND ELECTRICAL COORDINATION SCHEDULE

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Conform with applicable provisions of the General Conditions, Supplementary Conditions and General Requirements.

B. It is the responsibility of the Contractor to carefully coordinate all trades to provide a complete and operational system that conforms to the contract documents.

1.2 DEFINITIONS

A. “Furnished by” shall mean that the materials, equipment, wiring, etc. shall be provided to the project by the noted contractor unless specifically noted otherwise in the contract documents.

B. “Install by” shall mean that the materials, equipment, wiring, labor, etc. shall be installed (mounted in field) at coordinated locations for complete system and shall be completed by the noted contractor unless specifically noted otherwise in the contract documents.

C. “Control wiring” shall mean that the controls wiring including all supports connections, etc. shall be installed complete by Contractor noted unless specifically noted otherwise in the contract documents.

D. “Power wiring” shall mean that the power wiring including all supports connections, etc. shall be installed complete by the Contractor noted unless specifically noted otherwise in the contract documents.

E. “Connected by” shall mean that all required materials and labor shall be provided to and for the complete installation of all devices and equipment and shall be completed by the noted contractor unless specifically noted otherwise on the contract documents.

1.3 SCOPE: Make all connections to motors and controls for equipment furnished and/or installed under Mechanical and Electrical Specifications according to the following schedule unless otherwise noted on the contract documents:

Item	**Furnished By**	**Installed By**	**Control Wiring By**	**Power Wiring By**	**Connected By**
Fire/Smoke Dampers	Div. 23	Div. 23			
Fire/Smoke Dampers Linkages	Div. 23	Div. 23			
Fire/Smoke Dampers Actuators/Smoke Detectors	Div. 23	Div. 23	Div. 28 (d)	Div. 28 (e)	Div. 28 (d)
Fire Alarm Panel and Interfacing with A/C Systems	Div. 28 (d)	Div. 28 (d)	Div. 28 (d)	Div. 28 (d)	Div. 28 (d)
Hydronic Valves	Div. 25	Div. 25			
Hydronic Valves Actuators	Div. 25	Div. 25	Div. 25	Div. 26(e)	Div. 25
Flow Control Regulators	Div. 25	Div. 25	Div. 25	Div. 26(e)	Div. 25
Duct Smoke Detectors	Div. 25	Div. 25	Div. 28 (d)	Div. 26 (d)	Div. 28 (d)
Volume Control Dampers	Div. 23	Div. 23			
Volume Control Dampers Linkages	Div. 23	Div. 23			
Volume Control Dampers Actuators	Div. 23	Div. 23	Div. 23		Div. 23
120V Thermostat Backboxes & Wall Conduit	Div. 26	Div. 26			
DDC Electronic Thermostats	Div. 25	Div. 25	Div. 25		Div. 25

DDC Terminal Controls	Div. 25	Div. 25	Div. 25	Div. 26 (b)	Div. 25
DDC Zone Control Panels	Div. 25	Div. 25	Div. 25	Div. 26 (b)	Div. 25
DDC Backboxes and Cabinets	Div. 25	Div. 16			
Non-DDC Control Relays	Div. 25	Div. 25	Div. 26	Div. 25	Div. 25
Non-DDC Thermostats, Time	Div. 25	Div. 25	Div. 26	Div. 25	Div. 25
Non-DDC Control Transformers	Div. 25	Div. 25	Div. 25	Div. 26 (e)	Div. 25
HVAC Instrumentation (electronic temperature sensors, etc.)	Div. 25	Div. 25	Div. 25	Div. 26 (e)	Div. 25
Equipment Motors	Div. 23	Div. 23	Div. 26	Div. 26	Div. 26
Motor Control Centers with Starters, Overload Heaters, H-O-A Switches, Pilot Lights, Push Buttons, etc.	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Motor Starters & Overload Heaters Outside Motor Control Centers	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Fused & Unfused Disconnect Switches Thermal Overload & Heaters	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Manual Operating & Multispeed Switches (Low Voltage – Less than Line Voltage	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26
Pushbutton Stations & Pilot Lights	Div. 26	Div. 26	Div. 25	Div. 26	Div. 26
Fire Protection Sprinkler System Control Supervisory Panels and Devices O.S.0.&Y. Switch, Flow Switch	Div. 21	Div. 21	Div. 28 (d)	Div. 26	Div. 28 (d)
Heat Taping for Mechanical Systems	Div. 23	Div. 23	Div. 23	Div. 26 (e)	Div. 26 (e)
Variable Frequency Drives	Div. 23	Div. 26	Div. 23	Div. 26	Div. 26
Heat Tape for Roof drains or Gutters	Div. 26	Div. 26	Div. 26	Div. 26	Div. 26

Table Notes:

a. Unless specified to be furnished under Division 25 by the equipment supplier.
b. A dedicated isolated power circuit to Direct Digital Controls (DDC) Central Control Station shall be furnished and installed under Division 26.
c. Performed by the Fire Alarm Sub-Contractor Division 28
d. 120V connections by Div. 26

1.4 SUBSTITUTIONS: If the substitution of equipment, devices, or systems furnished under this Division result in changes to the Contract Drawings, Specifications and/or changes to the installation requirements, the complete responsibility and costs shall be assigned to the section of these Specifications under which the equipment is furnished with no additional costs to the Owner.

1.5 SUBMITTALS: In conjunction with the temperature control, Fire Extinguishing System, and DDC submittals, complete submittal data for each individual Electrically operated or Electrically controlled item of equipment or device furnished under this Division of these Specifications shall include Electrical wiring diagrams and elementary control diagrams (ladder form) showing all internal and external wiring connections and services and shall clearly indicate field wiring furnished and installed under Division 25, differentiated from field wiring furnished and installed under Division 26. The submittal data shall itemize all Electrical characteristics that are of a special nature or critical to the Electrical installation or control system. Such equipment and devices will not be considered for approval until these requirements are met. All submittal data shall be reviewed and approved by the General Contractor, Mechanical, Electrical and Controls Sub-Contractors prior to submission of the complete Temperature Control, Fire Extinguishing System and DDC submittal to the Architect. The submittals shall indicate all components that are to be wired into the control power circuit by the Electrical Sub-Contractor, with all terminals for external connections of the components identified and labeled to correspond to the manufacturer's designations. Internal or factory installed wiring of package-type components need not be shown.

The Shop Drawings for the system to be installed by the Temperature Controls, Fire Extinguishing System and DDC Sub-Contractors shall be prepared as complete submittals including all wiring requirements as described herein. Color coding designations shall be indicated for the control power circuit wiring.

PART 2 - PRODUCTS

2.1 REQUIREMENTS: The materials, equipment, and devices related to the Electrical System controls are specified under other sections of these Specifications.

PART 3 – EXECUTION

3.1 CHANGES DURING CONSTRUCTION

A. The complete responsibility and costs for revision during construction arising as a result of equipment substitutions, and any resultant changes to the installation requirements, shall be assigned to the respective section of these Specifications, under which the equipment is furnished at no additional costs to the Owner.

B. In the event of conflict in the delineation of responsibilities for the furnishing and installation of items of Mechanical equipment and the associated control and interlock wiring between Division 26, Division 25 shall provide all required material, labor, etc., to complete the work as shown in the contract documents.

3.2 INSTALLATION: No control work shall be performed until the reviewed and marked submittal data have been reissued to the Contractor, unless written permission is obtained from the Architect.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 27 00 00 COMMUNICATIONS INDEX

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All bids shall be based on the equipment as specified herein. The specifying authority must approve any alternate system.

B. Bidders wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications. Bidder shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and a demonstration of the system. Alternate supplier-contractor must also provide a list to include six installations of the identical system proposed which have been in operation for a period of two years.

C. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the contractor's expense.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 26 Sections apply to this Section:
   1. Basic Electrical Requirements.
   2. Basic Electrical Materials and Methods.

1.3 COMMUNICATIONS DIVISION INDEX

27 05 00	COMMON WORK RESULTS FOR COMMUNICATIONS
27 05 26	GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
27 05 28.2	PATHWAYS
27 05 43	UNDERGROUND DUCT AND RACEWAYS
27 05 53	IDENTIFICATION FOR COMMUNICATION SYSTEM
27 08 00	COMMISSIONING AND ACCEPTANCE
27 10 05	STRUCTURED CABLING FOR VOICE AND DATA - INSIDE-PLANT
27 11 16	CABINETS, RACKS, FRAMES, AND ENCLOSURES
27 11 19	TERMINATION BLOCKS AND PATCH PANELS
27 13 13	COPPER CABLE SPLICING AND OUTSIDE PROTECTED TERMINATIONS
27 13 23	FIBER OPTIC BACKBONE CABLING
27 14 13	COPPER RISER AND INTRABUILDING CABLING
27 15 23.2	FIBER OPTIC HORIZONTAL CABLING
27 15 43	FACEPLATES AND CONNECTORS

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

FSECTION 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 – GENERAL

A. The Contractor is held responsible to be familiar with the provisions of all contract division contained herein and with other Sections of these Specifications as applicable to the completion of the installation of all communication systems as indicated in the contract documents. The Contractor is held responsible to be familiar with the requirements contained herein and shall possess the knowledge, manpower, and material applied to the completion of the installation.

B. This section describes the installation locations for the products and materials, as well as methods and specification standards associated with the Information Technologies installation portions of the project. These specifications, along with the drawings shall be followed during the construction and installation of all Division 22 systems.

C. The contractor is required to be currently listed as a registered Manufacturer Certified Installer and Warranty Provider of the products to be installed.

D. Contractors shall provide all labor personnel for cabling and infrastructure installations who are trained and certified by the manufacturer in the installation of the submitted products, and requirements of this document.

1.1 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the construction, installation, termination, testing, and labeling of all information technology infrastructure as described on the drawings and/or required by these specifications.

B. The Contractor is required to be knowledgeable in all of the related sections contained within the specifications standards to ensure that common work results are achieved.

C. In addition to the installation and construction requirements of these documents, all project-related design and construction shall meet the requirements of the contract documents.

1.2 RELATED SECTIONS

Division 26 – Electrical
Division 27 – Communications
Division 28 – Electronic Safety and Security
Any CSI Division that impacts Division 27 Specifications

1.3 INTENT OF DRAWINGS AND SPECIFICATIONS

A. These Specifications and Drawings shall depict the Information Technology infrastructure and cabling requirements for installation. Contractors shall furnish labor and material shown and/or called for on the Drawing but not mentioned in the Specifications, or vise/versa, that are necessary for the installation and support of communications cabling whether or not specifically called for in both documents. In addition, the Contractor shall provide incidental equipment and material required for the completion of systems included in this contract whether or not specified or shown on the drawings.

1.4 DEFINITIONS

A. **Approved/Approval:** Written permission to use a material, installation method, or system agreed upon by the Engineer and Architect.

B. **Air Blown Fiber: - ABF**: Fiber Optic Cable designed to be installed in a Micro Duct system with air pressure.

C. **Bonding Conductor - BC:** An insulated copper conductor that bonds the Telecommunications Main Grounding Busbar to the Service Equipment (power) Ground.

D. **Backbone:** A facility (e.g., pathway, cable, or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities, and equipment rooms, within or between buildings.

E. **Backbone Cabling:** Cabling and connections hardware that provides interconnections between telecommunications rooms, equipment rooms, and entrance facilities.

F. **Building Distribution Frame – BDF:** The BDF is designated as the point where the outside plant cable terminates on the building entrance terminal (first-level backbone). These Building entrance terminals include provisions for optical fiber/twisted-pair cabling coming from the campus telephone switch facility where the Main Distribution Frame (MDF) is located.

G. **Connector (Jack):** A female telecommunications connection that may be keyed or unkeyed and may have 2 to 8 contacts connections that may be positioned, but not all the positions need to be equipped with contacts. Jacks are typically used to terminate cable at the endpoint and are inserted into faceplates to create a connection point for the user's equipment cord.

H. **Electromagnetic Interference – EMI:** Radiated or conducted electromagnetic energy that has an undesirable effect on electronic equipment of signal transmission.

I. **Equipment Room – ER:** An environmentally controlled centralized space for telecommunications that houses a main or intermediate cross-connect. An ER can contain equipment to support all of the following: (BDF) entrance protection, cable infrastructure pathway, data, and voice services, PBX, demarcation point, wireless, paging, fire/smoke detection, security alarm systems, radio, area of rescue assistance equipment, CATV and video conference.

J. **Furnish:** Supply and deliver installed in the approved designated area.

K. **Horizontal Cabling:** The cabling between and including the work area telecommunications outlet connector and the horizontal cross-connect/patch panels in the telecommunications room. This is a typical Category 6, 6A, 4 pair cable, but can also include multiple fiber cables for the desktop, coaxial cables, and other multi-media types of cables that provide service to end-user equipment.

L. **Install:** Mount and connect equipment and associated materials ready for use.

M. **Intermediate Distribution Frame – IDF:** A frame, rack, or termination block that connects to the BDF with copper optical fiber riser cables and distributes horizontal wiring to rooms (Second Level). In some situations, a BDF may serve this function.

N. **Inter Building Cable Plant:** Outside plant cable or infrastructure connecting two or more buildings for distribution of telephone, data, video, and control signals.

O. **Intra-Building Cable Plant:** Inside cabling or infrastructure within a building for the distribution of telephone, data, video, coaxial, and control signals.

P. **Multi Duct - MD:** this is multiple small ducts typically 8mm OD by 6.5 mm ID within an outer duct used for air blow fiber made by Dura-Line. Materials are made to match NEC Code requirements.

Q. **Outside Plant:** Telecommunications infrastructure designed installation exterior to buildings.

R. **Power Over Ethernet – POE:** POE or "Active Ethernet" eliminates the need to run 110/120 VAC power to a Wireless Access Point and other devices on a wired LAN. Using POE systems installers need to run only a single Communications cable capable to handle the power requirements of the network device, both data and power are carried on the cable. This allows greater flexibility in locating the WAPs and network devices and significantly decreases installation costs in many areas.

S. **Private Branch Exchange – PBX:** A private telecommunications switching system.

T. **Protector:** A device to protect facilities and equipment from abnormally high voltages or currents.

U. **Provide:** Furnish, install connect readily for use.

V. **Pull Point:** A Pull Point is a space or assessable electrical box used to access cabling between floors for backbone and horizontal cabling within a building riser system.

W. **Required:** Necessary mandatory must be done.

X. **Shall:** A required practice, procedure, or method, mandatory requirement.

Y. **Structured Cabling System (Universal Cabling System):** The complete collective configuration of telecommunications cabling and associated hardware at a given location. A structured cabling system is a cabling system where voice, data, video, and other low- voltage services are provided over the same cable media. All new cabling systems shall be of a structured design. The purpose of a structured cabling system is

to cable a building for information needs without knowing specifically what equipment or services will be utilized on it. A structured cabling system is geared toward long-term sustainability and flexibility.

Z. **Telecommunications:** A branch of technology concerned with the transmission, emission, and reception of signs, signals, writing, images, and sounds: that is information, of any nature by cable radio, optical, or other electromagnetic systems.

AA. **Telecommunications Bonding Backbone - TBB:** An insulated copper conductor that bonds all TGBs to TMGB.

BB. **Telecommunications Bonding Backbone Interconnecting Bonding Conductor – TBBIBC:** An insulated copper conductor that bonds two or more TBBs together in a multistory building.

CC. **Telecommunications Grounding Busbar – TGB:** A copper grounding busbar is installed in every TR and is bonded to the TMGB by the TBB. All metallic items in the TRs are connected to TGB**.**

DD. **Telecommunications Main Grounding Busbar – TMGB:** A copper ground busbar installed in the BDF or EDF and is bonded to the Service Equipment (power) ground by the Bonding Conductor (BC). It serves as a dedicated extension of the building grounding electrode system for telecommunications.

EE. **Telecommunications Outlet** – TO: The standard telecommunications outlet is a device in the work area where a horizontal cable is terminated. This outlet is typically provisioned with three ports and the unused ports are blanked. The maximum capacity is six ports of Category 6, 6 Augmented cables, optical fiber, and/or coaxial cables Face plates should match existing face plates in the area and the electrical faceplates on new projects.

FF. **Telecommunications Room – TR:** A TR is a special-purpose room designed to provide IT services on a single floor. In buildings with multiple floors, TRs shall be vertically stacked to form a backbone pathway. The TR is a termination point in the voice and data infrastructure that the backbone and horizontal distribution cabling are connected. to each other. A TR can contain equipment to support all of the following: cabling infrastructure, data and voice communications, wireless (satellite), paging, fire/ smoke detection, security alarm systems, radio, area of rescue assistance equipment, CATV, and video conferencing. (may be listed as ITTR, IT Closet, Telecommunications Closet TC).

GG. **Universal Cabling System - UCS:** A USC is a cabling system where voice, data, video, and other low-voltage services are provided over the same cable media. All new cabling systems shall be of a UCS design. The purpose of a UCS is to cable a building for information needs without knowing specifically what equipment or services will be utilized on it. A UCS is geared toward long-term sustainability and flexibility.

HH. **Wireless Access Point – WAP or AP:** Wireless access points are specially configured nodes on wireless local area networks (WLANs). Access points act as the central transmitter and receiver of WLAN radio signals.

II. **Voice over Internet Protocol – VoIP:** VoIP is the transmission of voice traffic over IP- based networks.

1.5 ACRONYMS

A.	**AFF**	Above Finished Floor
B.	**ARCH**	Architectural
C.	**MEP**	Mechanical, Electrical, Plumbing
D.	**CAT**	Category
E.	**CATV**	Cable Television
F.	**ER**	Equipment Room
G.	**EMI**	Electromagnetic Interference
H.	**F/UTP**	Foiled Shield Twisted Pair
I.	**MH**	Maintenance Hole
J.	**IT**	Information Technology

K. **PB** Pull Box

L. **PP** Pull Point

M. **TGB** Telecommunications Grounding Busbar

N. **TMGB** Telecommunications Main Grounding Busbar

O. **TR** Telecommunications Room

P. **PBX** Private Branch Exchange (Phone Switch)

Q. **UTP** Unshielded Twisted Pair

R. **WAP** Wireless Access Point

The BICSI Telecommunications Manuals are available as references for additional definitions and acronyms.

1.6 REFERENCES ORGANIZATIONS

A. The following organizations publish telecommunications construction standards with provisions that, through reference in this text, constitute provisions of this specification:
1. Building Industry Consulting Services International (BICSI)
2. Telecommunications Industry Association (TIA)
3. Electronic Industry Alliance (EIA)
4. National Electrical Code (NEC)
5. National Electrical Safety Code (NESC)
6. National Fire Prevention Association (NFPA)
7. American National Standard Institute (ANSI)

1.7 STANDARDS AND REFERENCES

A. The following list of methods and standards included in the References Organizations are considered part of the requirements of this specification. This is a list of primary references and does not limit the applicability of other standards that are incorporated into the list of References Organizations applicable to the work described in these practices, described in Standards documents (and addenda) published by recognized standard bodies and organizations. All references listed are considered to be of the latest edition printed. These include standards published by the Telecommunications Industry Association / Electronics Industries Alliance (TIA/EIA) and Building Industry Consultant Services International (BICSI).
1. BICSI TDMM and Specialty Manuals, Building Industry Consultant Services International, *Telecommunications Distribution Methods Manual*.
2. ANSI/TIA/EIA 568, *Commercial Building Telecommunications Cabling Standard.*
3. ANSI/TIA-568-C.0-2009+A1:2010+A2:2012, *Generic Telecommunications Cabling for Customer Premises.*
4. ANSI/TIA-568-C.2–2009+A1:2010, *Balanced Twisted-Pair Telecommunications Cabling and Components Standard*
5. ANSI/TIA-568-C.3–2009+A1:2011, *Optical Fiber Cabling Components Standard.*
6. ANSI/TIA-568-C.4–2011, *Broadband Coaxial Cabling and Components Standard.*
7. ANSI/TIA/EIA 569, *Telecommunications Standard for Pathways and Spaces.*
8. ANSI/TIA/EIA 607, *Commercial Building Grounding and Bonding Requirement.*
9. ANSI/TIA/EIA 758, BICSI *Customer-Owned Outside Plant Telecommunications Cabling Standard.*
10. ANSI/TIA/EIA 862 *Building Automation Systems Cabling Standard Cabling for Commercial Buildings.*
11. ANSI/NFPA 70, National Electrical Code, (NEC).
12. TIA-526-7 (OFSTP-7)-2002+A1:2008, *Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.*
13. TIA-526-14-B-2010 (OFSTP-14), *Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 Edition 2, Fibre-Optic Communications Subsystem Test Procedure- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement*.
14. Building Industries Consulting Services International (BICSI) *Telecommunications Distribution Methods Manual* (TDMM).

PART 2 – PRODUCTS

2.1 PRODUCTS STANDARD

A. All materials shall conform to the currently applicable industry standard including, but not limited to:

1. Electronic Industries Alliance (EIA)
2. American National Standard Institute (ANSI)
3. National Electrical Manufactures' Association (NEMA)
4. American Society for Testing and Materials (ASTM)
5. Insulated Cable Engineers Association (ICEA)
6. Institute of Electrical and Electronic Engineers (IEEE)
7. National Electrical Safety Code (NESC)

B. In addition, all material shall be Underwrites Laboratories Listed unless otherwise indicated.

C. The approved product manufacturers are listed as an Appendix to this specification.

D. All products shall be new.

E. Products substitutions shall be managed according to the following guidelines:
1. All product submittals shall be approved by the Architect or Engineer before purchasing by the Contractor.
2. Where specified only by reference standard, select any approved product meeting standard of the manufacturer.
3. Where specified by naming several products or manufacturers, select any product and manufacture named in this Standard Specification.
4. Where specified by naming one or more products or manufacturers, but indicating "or approved equivalent" after the specified listing, the specified product is the preferred quality standard. The Contractor shall submit a request for the equivalent product for approval.
5. Where specified by naming only one product and manufacture: There is no option and no substitutions that will be allowed without prior approval.
6. Submit requests for substitution within 10 days of contract award, or sooner if required to maintain the construction schedule.
7. The Contractor must submit sufficient information to show that a proposed substitute is equivalent to the item specified.
8. Acceptance of substitutions is at the discretion of the Architect or Engineer. The Architect or Engineer reserve the right to determine the suitability of the substitute product and reject any material submitted for substitution.
9. All substituted products and materials must be approved for substitution by the Architect or Engineer in writing before installation.
10. Products rejected or otherwise judged unsatisfactory by the Architect or Engineer will not be authorized for use in completing the work. Any unapproved products discovered as part of the installation will be removed by the Contractor and replaced with specified and approved products at the Contractor's expense.
11. Project Drawings may be based on the equipment configuration of a particular manufacturer. If a substitution is approved, the Contractor shall make changes needed to accommodate the substitution at no expense to the project, including work under other divisions.

PART 3 – EXECUTION

3.1 IT INSTALLATION

A. Each Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate common work results with all trades.

B. The Contractor shall be responsible for furnishing all materials on the drawings, specifications,- and addendums as specified herein for a complete IT system.

C. All IT infrastructures shall be installed in a "workmanlike manner" acceptable to the Architect and Engineer; any work not acceptable to the Architect and Engineer shall be removed and installed at Contractor's expense.

D. All work shall be completed in a "workmanlike manner" as specified by the NFPA standards.

E. All work by the Contractor must comply with applicable standard listed in this Specification.

F. The contractor is required to provide all drawings and obtain all permits from the proper jurisdiction for all work associated with this specification.

G. All IT infrastructures shall be installed to ensure optimal performance.

H. All existing and new IT infrastructure shall be installed to accommodate new work and modifications.

I. All work performed in occupied space shall be in a manner that allows the Owner to operate the existing facilities continuously.

J. All work that will affect the user connectivity, including wireless access points, shall be submitted for approval to the Owner two weeks before starting.

K. New Telecommunication Rooms must be free from dust, dirt, and other foreign materials before the installation of any termination hardware or the termination of copper or fiber optic.

L. The contractor shall provide a Manufacturer's Warranty of not less than 20 years on the structured cabling systems and components.

M. All work by the contractor must comply with the manufacturer's product- recommended installation and warranty requirements.

N. The Contractor shall provide all redlines, station documentation, and test results two weeks before substantial completion or end user move-in, whichever is first.

O. The Contractor shall abide by all work rules, safety and security requirements, schedules, and other requirements established by the General Contractor related to the work area or project.

3.2 SCHEDULES

A. Information Technologies (IT) Milestones shall be included and updated in all project schedules. Updates for these IT Milestones shall be provided at all construction meetings.

B. An IT project schedule shall be provided and approved by the Owner before the commencement of any work.

C. The Contractor is responsible for scheduling inspections with Owner/Architect which are required after the following milestones but not limited to:
   1. Site Utility Locations.
   2. Communication Site Utility Rough-in, before covering (Concrete/backfill, etc.).
   3. Pathways and Electrical Rough-in before covering (In-wall/Ceilings/Floors).
   4. IT room Rough-in.
   5. IT room to build out (i.e., Cable tray, grounding, equipment racks, sleeves, firestop systems, power, etc.).
   6. Cable installation.
   7. Cable termination.
   8. Labeling.
   9. Testing.
   10. IT punch list.
   11. Final acceptance.

3.3 DELIVERABLES TO OWNER/ARCHITECT

A. IT Subcontractor (before start)
   1. Qualifications
   2. Certifications

B. Product Submittals, including specification data, prior to purchase.

C. Schedules including timelines and milestones before starting any work and updated when changed.

D. Test Results. (after testing and a minimum of 2 weeks to planned activation)

E. Telecommunications Outlet Numbering Plan/Intra Building Numbering Sheets (IBNS) and a copy of the working as-built drawings. (after testing and a minimum of 2 weeks before planned activation).

F. Final As-built Drawings shall be delivered to the Architect and Engineer two weeks after occupancy in both hard and electronic format. Any new outside plant or specified project as-built drawings require Auto Cad update.

PART 4 – APPENDIX FOR APPROVED PARTS LIST

4.1 The following table lists the most commonly used components of the AMP NetConnect Category 6 & 6A copper horizontal cabling system, Corning Cable Systems LANscape fiber backbone system, and Chatsworth Products ladder rack, racks, cable mangers and grounding components. These systems contain too many parts to list them all in this document. Consult the manufacturer's websites for the most current item descriptions and part numbers. Any substitutions must be approved by ICT.

4.2 **ATTENTION ELECTRICIANS, TELECOMMUNICATIONS, AND FURNITURE CONTRACTORS**

A. Modular furniture, tombstones, poke-throughs, and in-floor boxes will require careful consideration when purchasing these items. Not all bezels are compatible with AMP NetConnect modular jacks. Do not install incompatible fixtures where telecommunications outlets are required.

AMP NetConnect	
620 Series, Category 6 UTP Cable, CMR, Blue	TE620P-BL RB
620 Series, Category 6 UTP Cable, CMR, White	TE620P-WT RB
620 Series, Category 6 UTP Cable, CMP, Blue	TE620R-BL RB
620 Series, Category 6 UTP Cable, CMP, White	TE620R-WT RB
640 Series, Category 6E U/UTP Twisted Pair Cable, CMR, Blue	TE640P-BL 02
640 Series, Category 6E U/UTP Twisted Pair Cable, CMR, White	TE640P-WT 02
640 Series, Category 6E U/UTP Twisted Pair Cable, CMP, Blue	TE640R-BL 02
640 Series, Category 6E U/UTP Twisted Pair Cable, CMP, White	TE640R-WT 02
Category 6E, 48 Port, Angled Patch Panel	2111573-1
Category 6E, Modular Jack, Orange	1933476-5
Category 6E, Modular Jack, Blue	1933476-6
Category 6E, Modular Jack, Black	1933476-2
Category 6E, Modular Jack, Yellow	1933476-8
Category 6E, Modular Jack, Green	1933476-9
Category 6, 48 Port, Angled Patch Panel	1375015-2
Category 6 Modular Jack, Orange	1375055-5
Category 6 Modular Jack, Blue	1375055-6
Category 6 Modular Jack, Yellow	1375055-8
Category 6 Modular Jack, Black	1375055-2
Category 6 Modular Jack, Green	1375055-9
SL Series Multimedia Inserts, Almond	Various
Faceplate 4-Port, SG, Almond	558088-1
Faceplate 2-Port, SG, Almond	557505-1
Faceplate 4-Port, DG, Almond	83935-1

Corning LANscape	
Fiber Fan Out Kit 12 Pos/25	FAN-BT 25-12
Wall Mount Housing F-12 WCH-12P	WCH-12P
6P Panel Rack CCH SC SM CCH-CP12-59	CCH-CP12-59
LANscape Wall Mount Splice Housing WSH-16SPT	WSH-16SPT
Splice Protection Heat Shrink (pkg-50)	2806031-01
Unicam ST MM 95-000-50	95-000-50
Fiber 48F SM LT Altos	048EU4-T 4701D20
24/96-F Rack Mount Enclosure CCH-02U	CCH-02U
12/48-F Rack Mount Enclosure	CCH-01U
Fiber 48-F MIC SM Plenum	048E88-61131-29
Connector Splice Housing CSH-05U	CSH-05U
SM / MM Splice Tray M67-048	M67-048
Corning Splice Tray/12 - M67-060	M67-060
Fiber Enclosure BGE LANScape EDC-06P-NH	EDC-06P-NH
Wall Mount Splice Cabinet WCH-SSH-4-12	WCH-SSH-4-12
Wall Mount Connector Housing WCH-04P	WCH-04P
Closet Connector Housing, 12 Panel	CCH-04U
FUSELITE SC SM BLUE PRE-POL ISHE D FERRULE	AS236342
Fiber 96F SM Altos	096EU4-T 4101D20
MIC SM PVC Fiber Optic cable	012E81-33131-24
Fiber Clean Wipes	FC-45-1

Chatsworth Products Inc.

UNIVE RSAL CABLE RUNWAY, Black, 12 inch wide	10250-712
Butt-Splice Kit, Black 16301-701	
Intelligent Fan Kit, For ThinLine II Wall-Mount Cabinet	13051-001
G3 Double-Sided Cable Managers	35523-701
G3 Combination Vertical Cable Managers	35573-701
Universal Rack, 7' high, 19", Black	46353-701
Evolution Horizontal Cable Manager, 2U, Black	35441-700
ThinLine II Wall-Mount Cabinet, Beige	13050-222
Intelligent Fan Kit, For ThinLine II Wall-Mount Cabinet	13051-000
G3 Double-Sided Cable Managers	35523-702
G3 Combination Vertical Cable Managers	35573-702
Universal Rack, 7' high, 19", Black	46352-702
Evolution Horizontal Cable Manager, 2U, Black	35441-701
ThinLine II Wall-Mount Cabinet, Beige	13050-223
Intelligent Fan Kit, For ThinLine II Wall-Mount Cabinet	13051-001
G3 Double-Sided Cable Managers	35523-703
G3 Combination Vertical Cable Managers	35573-703
Universal Rack, 7' high, 19", Black	46352-703
Evolution Horizontal Cable Manager, 2U, Black	35441-702

END OF SECTION

SECTION 27 05 26 GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor is held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation. The Contractor is held responsible to be familiar with the provisions contained herein and is assumed to possess the knowledge, manpower, and materials necessary for the completion of the installation.

B. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing otherwise specified, and performing the following operations recognized as necessary for the complete installation, termination, and labeling of ground and bonding infrastructure as described on the Drawing and /or required by these specifications.

C. Listed manufacturers and products are required. Owner IT Networks approved equivalent products and systems are also acceptable with the prior written approval of submittals.

1.2 RELATED SECTIONS

A. Division 26 - Electrical Division

B. Division 27 - Communicants Systems.

C. Division 28 - Electronic Safety and Security

PART 2 - PRODUCTS

2.1 GROUNDING BUSBARS

A. Telecommunications Grounding Main Grounding Busbar (TMGB).
   1. Predrilled, copper, non-anodized BICSI/TIA/EIA/ANSI approved (4”W **x** 1/4”H **x** 12”L) ground bus bar with insulators and standoffs. (Chatsworth 40153-012 or Owner IT approved equivalent)

B. Telecommunications Grounding Busbar (TGB)
   1. Predrilled, copper, non-anodized BICSI/TIA/EIA/ANSI approved (2”W **x** 1/4”H **x** 12”L) ground bus bar with insulators and standoffs. (Chatsworth 13622-012 or Owner IT approved equivalent)

2.2 GROUNDING JOINTS AND SPLICES

A. Grounding conductor joints/ splices shall be mechanical type, copper alloy, with a minimum of two bolts and a spade section for each conductor.

B. Grounding conductor terminations (lugs) shall be a single barrel, mechanical screw type, copper alloy with machined contact surfaces.

2.3 BONDING CONDUCTORS

A. Cable Tray Bonding Conductor.
   1. Green # 6 AWG insulated bonding jumper with appropriate lugs or manufactured braided copper grounding jumper.

B. Equipment Fame Bonding Conductor.
   1. Chatsworth TRGK672 Telecommunications Rack Grounding Kit or Owner IT approved equivalent.

C. Bonding Conductor (BC)
   1. Green insulated copper bonding conductor, size as required by NEC.
   2. The BC shall be, as a minimum the same as the TBB.

D. Telecommunications Bonding Backbone (TBB)
   1. Green insulated copper conductor, a minimum size of #6 AWG. The TBB shall be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/) AWG Insulation shall meet fire ratings of its pathway or be in conduit.

SEE TABLE 1 BELOW

TABLE 1					
Sizing of Telecommunication Bonding Backbone (TBB)					
TBB length FT	Grounding Conductor Size (AWG)	DC Resistance Per 100 Ft (Copper Conductor)	Short-Time Rating (A)		
< 13 Ft	6	0.0491	621		
14 - 20 Ft	4	0.0308	988		
21 -26 Ft	3	0.0245	1245		
27 - 33 Ft	2	0.194	1571		
34 - 41 Ft	1	0.0154	1981		
42 - 52 Ft	1/O	0.0122	2499		
53 - 66 Ft	2/O	0.00967	3150		
> 66 FT	3/O	0.00766	3972		
	4/O	0.00608	5008		
	kcmil				
	250	0.00515	5917		
	300	0.00429	7101		
	350	0.00367	8284		
	400	0.00321	9467		
	500	0.00258	11834		
	AWG = American Wire Gauge				
	DC = Direct Current				
	kcmil = Thousand circular mils				

PART 3 - EXECUTION

3.1 TELECOMMUNICATIONS INSTALLATION

A. Bonding and grounding all conduits, cable trays, enclosures, cables, protectors, and other conductive infrastructure as per the requirements of the NEC and TIA 607 to main building ground.
   1. Nonconductive coatings (such as paint, lacquer, and enamel) on equipment to be grounded shall be removed from threads and other contact surfaces to ensure good electrical continuity or be connected utilizing fittings designed to make such removal unnecessary.

B. Installation of the TMGB in ER/TR.
   1. Install the TMGB at the bottom of the plywood backboard near the entrance conduits within the ER/TR Room.
   2. TMGB shall be installed so that the BC is as short and straight as possible, with the proper bend radius.
   3. The BC shall be a green insulated conductor installed exposed per Table 1.
   4. Connection at TMGB from the main electrical service ground shall be installed to meet NEC 250.94 and TIA/EIA requirements type. Ground resistance shall not exceed 2 ohms unless approved by the Architect or Engineer.
   5. Busbar shall be predrilled for future connections. (Chatsworth 40153-012 or approved equal.)
   6. Provide a label (Do Not Disconnect) on the connection to the main electrical service ground.

C. Installation of TGB in TR.
   1. Install the TGB at the bottom of the plywood backboard near the copper riser terminations within the Owner IT Telecommunications Space.

2. TGB shall be installed so that the TBB for telecommunications is as short and straight as possible, with the proper bend radius.
3. The BC shall be Green insulated conductor sized from Table 1.
4. Busbar shall be predrilled for future connections. (Chatsworth 13622-012 or approved equal.)

D. Installation of the TBB.
1. Installation mechanical type, copper alloy, with a minimum of two bolts and separate sections for each conductor or copper compression type with two (2) indents

E. Installation of Grounding Conductor Joints/Splices.
1. Install manufactured insulating cover or heavy tape insulation over joints/splices.

F. Grounding of Cable Tray/Ladder Rack/Basket Tray
1. Install Green #6 AWG bonding jumper (12 inches max) with appropriate lugs at each cable tray joint or install a manufactured braid copper grounding jumper. In place of bonding jumpers, use manufactures approved grounding type connectors to connect sections of cable trays will be permitted.
2. Install Green #6 AWG grounding conductor with appropriate lugs from the side of the cable tray down to TMGB or TGB. Drill the side of the cable tray and install a ¼” fine thread appropriate length bolt, making sure that the bolt does extend into the wire management part of the tray.

G. Ground of Equipment Frame.
1. Install Telecommunications Rack Grounding Kit approved by the Architect or Engineer, from equipment frame to ground cable tray, TMGB or TGB.

H. Grounding of Telecommunications Duct banks.
1. Provide a continuous # 4/0 bare-stranded copper conductor within the concrete at the bottom of all Duct banks. Terminate the bonding ribbon in telecommunications maintenance holes.

I. Grounding of Telecommunications Maintenance Holes and Handholes.
1. Provide bonding jumper to reinforcing steel in each section.
2. Install a bonding ribbon horizontally around the bottom of each maintenance hole and attached it to all the cable racks and metallic hardware within the maintenance hole. Continue installation vertically between the bonding clamps so both the top and bottom halves are bonded together on each side. (The bonding ribbon will be used to bond and ground all future splice cases and hardware placed within the maintenance hole).
3. Provide a ground rod near a corner within 6” of the corner in each maintenance hole and handhole. Bond to the ribbon in the maintenance hole.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 27 05 28.2 PATHWAYS

PART 1 - GENERAL

A. The Contractor is responsible to be knowledgeable with provisions contained herein and with other Sections of this Specification as applicable to the work related to this section.

1.1 SCOPE OF WORK

A. The scope of work under this section consists of providing conduits, boxes, raceways, pathways, and cable supports for telecommunications wiring included in this project.

B. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, and material, unless otherwise specified, and performing the following operations are necessary for the installation and testing of all infrastructure required by this specification's standard.

C. The horizontal infrastructure begins in the telecommunications room (TR) and is terminated at the telecommunications outlet that is located in the end user work area.

D. Only the Architect/Engineer or Owner-approved manufacturers for structured cabling systems shall be installed in the pathways. The exact Category performance requirements are project specific. Verify and comply with manufacturer installation and warranty requirements when designing and installing structured cabling systems.

E. The typical Telecommunications Outlet is a Category 6 faceplate that shall be provisioned to accept four (4) ports. The standard installation is two (2) Category 6E cables and two (2) 8P8C jacks. There will be applications where other cabling requirements are needed. When these cables are added to the Telecommunications Outlet such as (Category 6, 6A, F/UTP Fiber, or Coax) use approved jacks. The sizing of the pathway will need to be adjusted to meet additional cabling requirements. Initial installation shall have a 40% fill rate.

F. Provide conduits and boxes for Code Blue Emergency Phones, Elevator Phones, mechanical and electrical metering equipment, and wall phones.

G. Furnish and install an inter-building cabling infrastructure and pathways. Originate the system from the building's main equipment room and distribute it to the telecommunications room.

H. Furnish and install raceways and cable tray systems in hallways and other accessible areas, above ceilings where applicable or as specified in the project documents and drawings.

I. Transition cable tray to conduit systems in inaccessible areas. Must meet the same volume as the tray.

J. Install cable tray and raceway systems according to the manufacturers' product installation instructions using the manufacturers' approved methods and components.

K. Furnish, install, and document re-enterable UL-listed firestop assemblies at all firewall penetrations. (Architect or Engineer-approved firestop systems are Hilti and/or STI.) Document means the manufactures label is permanently attached to the wall located adjacent to the penetration along with a photo taken and submitted to Owner.

1.2 RELATED SECTIONS

A. Division 26 Electrical Division

B. Division 27 Communicants Systems.

C. Division 28 Electronic Safety and Security

1.3 RELATED REFERENCES

A. All work performed under this section must comply with the manufacturer's approved methods and comply with the most recent versions of the following Industry Standards and Practices applicable to work being performed under this section. The contractor shall have working knowledge and possess the following documents of the Standards and Methods listed and must adhere to the most recent published edition.
   1. National Fire Protection Association
   2. National Electrical Code

3. National Electrical Safety Code
4. Telecommunications Industry Association (including but not limited to)
   a) TIA/EIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces.
   b) TIA/EIA 758 3Customer-Owned Outside Plant Telecommunications Cabling Standard.
   c) TIA/EIA 568 Commercial Building Telecommunications Cabling Standard
   d) TIA/EIA 607 Grounding
5. Building Industry Consulting International (BICSI)
   a) Telecommunications Distribution Design Manual

PART 2 – PRODUCTS

2.1 TELECOMMUNICATIONS OUTLETS BOXES, FLOOR BOXES and SURFACE RACEWAYS

A. Telecommunication Outlets shall have the ability to accommodate a complete line of connectivity modules including those for UTP cables Category 6E, Category 6E Augmented F/UTP, fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting.
   1. It is the responsibility of the project RCDD, Electrical Engineer and Contractor to verify that the design requirements which are specified below have been met.
   2. It is the responsibility of the contractor to submit an RFI for any noted incorrect designs or conditions found that do not meet the requirements of this Specification Standard.

B. Furnish and install telecommunications outlets in studded drywall or masonry wall providing a 4 11/16” inch square 2 1/8” inch deep boxes with 1” inch mud ring provisioned with a 1” inch conduit knockouts. The box depth will be 3 1/8” inches. It is the responsibility of the designer, electrical contractor, and structured cabling contractor to identify and verify the conduit and box size to match the cabling requirements at each location.
   1. Fiber Optic, Category 6, and Category 6 Augmented F/UTP radius: The depth of the box shall accommodate a 1 ¼” inch cable bend radius, which meets or exceeds the specifications for fiber optic and UTP cabling per TIA/EIA-56 requirements for communications pathway. A 1 ¼” inch-controlled radius storage loop shall be installed.

C. The minimum requirement for all telecommunications outlets is 0.75” and a 1” inch conduit(s) as depicted on the drawing(s) provisioned with a bushing on each and a measured pulled line secured at each termination point for horizontal cabling installation. The conduit sizing and fill ratio shall be verified in design and provided to meet the requirements of the TIA/EIA 568, 569 with an initial installation fill ratio of 40% percent. Alternative pathway restrictions or allowances shall be approved by the Owner in writing prior to commencing the project.

D. For all horizontal cabling pathways provide a minimum of a 1” inch conduit from the outlet box to the nearest cable tray or conduit system. Terminate conduits above cable trays at approximately 12 inches to the nearest side rail.

E. In inaccessible as well as areas that are non-adjacent to spaces conduit shall be provided from the outlet box to the nearest cable tray or conduit system with no exceptions. Terminate conduits above cable trays at approximately 12” inches to the nearest side rail.

2.2 FLOOR BOXES

A. Floor boxes provide the interface between power, communication, and AV cabling in an on-grade or above-grade concrete floor where power and communications services are required. Boxes shall provide flush or recessed device outlets that will not obstruct the floor area.

B. Floor boxes and covers must be heavy-duty in construction, watertight, and easily accessible by users. Meeting and Exceeding Water Exclusion Standards in Poke-Thru Devices and Floor Boxes UL514A standards require that all concrete floor box covers and poke-thru devices meet a carpet water exclusion test. Water exclusion tests are designed to simulate typical maintenance procedures such as mopping tile floors and shampooing carpets.

C. All floor boxes shall be submitted and approved by the Architect or Engineer.
   1. An acceptable pre-approved box is Wiremold RFB6.

D. Communications Devices and Accessories: The floor box shall accommodate a complete line of connectivity outlets and snap-in modular inserts for UTP including Category 6, 6 Augmented F/UTP, fiber optic, coaxial, and other structured cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts. Bezels shall be supplied by the contractor furnishing the floor boxes.

E. Furnish and install 1 ½" EMT conduit to each floor box. In new construction, conduits should be run continuously from the outlet box to the cable tray installing pull boxes where necessary to meet bend radius requirements. **DO NOT DAISY CHAIN FLOOR BOXES.**

F. Covers and Bezels: Floor box options shall accept both brass and nonmetallic cover plates and flanges. Flanges for both brass and nonmetallic shall be available in one, two, and three gang applications and installed on boxes. Each flange shall provide ½" inch of adjustment to accommodate various floor covering and concrete depths.

G. Floor Boxes on "Slab on Grade" must have OSP category cable installed. Must be suitable for "wet locations". A suitable substitute cable must be approved by Owner.

2.3 POKE THRU DEVICES

A. Poke-thru devices provide a path for power and communications cabling in an above- grade concrete or steel deck floor and where the workstation is located where the power and data communication devices outlets are required.

B. Poke Thru Devices and covers must be heavy-duty in construction, watertight, and easily accessible by users. Meeting and Exceeding Water Exclusion Standards in Poke-Thru Devices and Floor Boxes UL514A standards require that all concrete floor box covers and poke-thru devices meet a carpet water exclusion test. Water exclusion tests are designed to simulate typical maintenance procedures such as mopping tile floors and shampooing carpets.

C. All Poke-thru devices shall be submitted and approved by the Architect or Engineer.

D. Poke-thru devices shall be suitable for use in air handling spaces in accordance with Section 300-22 of the National Electrical Code.

E. Furnish with necessary channels to provide complete separation of power and communication service. There shall be one minimum of 1 ¼" inch channels for communication cabling to the nearest cable pathway. The channels shall be arranged such that communication cables can be conduit protected and connected to the insert body.

F. Activation covers shall provide spring-loaded slides that snap back into place when not in use to protect the flush-mounted power receptacle.

G. Communications Devices and Accessories: Poke Thru Devices shall accommodate a complete line of connectivity outlets and snap-in modular inserts for UTP including Category 6, 6 Augmented F/UTP, fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts. Bezels shall be supplied by the contractor furnishing the Poke Thru.

H. The poke-thru shall have an incorporated approved UL firestop system that meets the rating of the floor.

I. Unit shall be installed per Manufacture Specifications.

2.4 CABLE TRAYS - Ladder Type

A. Acceptable Manufacturers are Chatsworth, Cooper B-Line.

B. All ladder-type cable trays, devices, and accessories shall be submitted to and approved by the Architect or Engineer.

C. Provide metal cable trays with splice plates, bolts, nuts, and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards and the manufacturer's instructions; and with the following additional construction features.
   1. Material and finish specifications for each tray type are as follows: Aluminum or Steel.
   2. Ladder-type trays shall consist of two longitudinal members (side rails minimum four inches) with transverse members (rungs) attached to the side rails. Rungs shall be spaced 6", 9", or 12" inches on center. Spacing in radiuses fittings shall be 9" inches and measured at the center of the tray width. Rungs shall have a minimum cable-bearing surface of 7/8" inch with radiuses edges. No portion of the rungs shall protrude below the bottom.

****Each rung must be capable of supporting the maximum cable load, with a safety factor of 1.5 and 200 pounds concentrated load when tested under NEMA VE-1, section 5.4.**

D. Tray widths shall be minimum of 12” inches or as shown on drawings.

E. All fittings must have a minimum radius of 18” inches.

F. Straight tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard lengths, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.

G. Splice plates shall be the bolted type as specified by the manufacturer. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing the rated loading capacity of the cable tray.

H. Cable Tray Supports shall be placed so that the support spans do not exceed the maximum span per manufacturer and NEC load rating. Supports shall be constructed from 12 gauge steel formed shape channel members 1 5/8” inch by 1 5/8” inch with necessary hardware, Unistrut or equal. The trapeze hanger’s supports shall be supported by ½´inch (minimum) diameter rods. Cable trays installed adjacent to walls shall be supported on wall-mounted brackets. Support shall be loading condition with a safety factor of 3.

I. Barrier Strips shall be placed as required.

J. Accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, barriers, waterfalls, etc.

2.5 NON-CONTINUOUS CABLE SUPPORTS – J-HOOKS

A. Acceptable Manufacturers are Erico, Cable Cat, or Owner-approved equal.

B. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with the required bend radii of high-performance cables (CAT 6 and Cat 6 Augmented); UL Listed.

C. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

D. Non-continuous cable supports shall have an electro-galvanized finish and shall be rated for indoor use in non-corrosive environments.

E. Saddles can be installed as approved by the Architect or Engineer.

2.6 HORIZONTAL CONDUIT DISTRIBUTION:

A. Furnish and install 4” inch EMT conduits in inaccessible areas to complete distribution infrastructure. Provide sufficient conduit capacity to meet the cabling capacity of the cable tray system. Furnish and install pull strings and bushing for conduit sections.

B. Hinged pull boxes with the opening completely assessable from below without obstructions. Install as required per TIA/EIA where conduit runs exceed 100 feet and/or bends exceed a total of 180 degrees in a section of conduit. Pull boxes sized per BICSI TDMM.

2.7 FIRESTOP

A. Acceptable Manufacturers: Hilti, STI, and Wiremold.

B. Furnish and install re-enterable UL-listed fire-rated assemblies through fire-rated partitions, walls, and floors. Installed per UL system assembly requirements.

C. Fire Rated Cable Pathways: Hilti Speed Sleeve, STI EZ-PATH™, and Wiremold modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
   1. Hilti Speed sleeve CP 653.
   2. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.
   3. Wiremold FS4R for conduit.

D. Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate structured cabling provide re-enterable products that do not cure or dry. Submittals shall be submitted to the Architect or Engineer for approval.

E. Cable trays shall not penetrate fire-rated walls or partitions and floors. Use Architect or Engineer- approved fire-rated assembly to penetrate walls and floors.

PART 3 - INTRA BUILDING INFRASTRUCTURE

3.1 GENERAL REQUIREMENTS

A. The intra-building pathways intend to provide the building with a route from the building's ER/TRs and spaces to the TOs at the end user's work area or equipment termination point.

B. The installation of new pathways shall not interfere with existing utilities or pathways. The contractor shall coordinate the installation of the new pathways with other trades and project requirements. Minimum clearances shall be 6" inches on sides 3 inches below and 12" inches above.

C. All pathways must remain accessible and useable after completion.

D. All pathways must comply with the list of related references listed in Part 1 of this section and comply with installation instructions and methods specified by the product manufacturer.

E. The contractor shall reference the related sections listed in Part 1 to determine any additional requirements necessary to complete the project.

3.2 TELECOMMUNICATIONS OUTLETS

A. New construction telecommunications outlets shall be installed at a minimum of 18" inches AFF unless specified.

B. The telecommunications outlet box will be a 4-11/16" inch square box with a 1" extension ring fitted with a single gang mud plate.

C. The telecommunications outlet shall be provisioned minimum with a 1" inch EMT conduit that has bushings installed and a measured pull line installed and secured at the conduits terminations points.

D. Telecommunications outlets are not to be installed back-to-back.

E. Firestop the outlet box using a listed UL application in firewalls.

F. Renovated Areas of Existing Buildings Alternate – When approved by the Architect or Engineer.
   1. In accessible ceiling areas, extend the conduit through the wall plate and bend the conduit 90º to face the nearest cable tray, or access conduit or sleeve.

G. Provide a minimum of one (1) 2" inch EMT sleeve on non-rated walls from the cable tray into each room. On fire-rated walls use Architect or Engineer-approved firestop sleeve as per 2.11 Firestop. In inaccessible or semi-accessible ceiling areas, install a complete 1" inch minimum EMT conduit system from the telecommunications outlet box to the nearest or most available cable tray.

H. Install system Category-compliant cable supports every 36" to 60" inches.

I. Conduit needs to run in the most direct route possible, parallel with building lines and in a workman-like manner.

J. The use of flexible metallic conduit is not permitted.

K. Specify UL-listed fire-stopping application for conduit and sleeve penetrations using a code-compliant and re-enterable application as per 2.11 Firestop. Document and provide to the owner a photo of the application, the name of the listed application, the date of installation, and the name of the installer.

3.3 GENERAL CONDUIT REQUIREMENTS

A. Horizontal conduit routes are to be designed to enable the cabling system to meet the link length requirements of 295 feet.

B. Intra-building conduit runs shall contain no continuous sections longer than 100 feet. If runs total more than 100 feet, pull points or pull boxes shall be inserted.

C. Conduit shall have no more than 180 degrees of cumulative bends between pull points or more than 90 degrees of bends at any one point.

D. The use of a third conduit bend is only acceptable if:
   1. The total conduit run does not exceed 33' feet.
   2. The conduit is increased to the next trade size.
   3. One of the bends is located within 12" inches of the cable feed end.

E. Pull boxes are not to be used as a means to change the direction of conduit runs. Pull boxes are to be sized as per the latest version of the BICSI TDMM.

F. The use of EB's is not permitted. Only approver LB type bodies that are manufacturers for the use with communications cabling.

G. Specify UL listed fire-stopping application for conduit and sleeve penetrations using a code-compliant application in the fire-stopping section. Install a Hilti or STI UL compliant and re-enterable application as per 2.11 Firestop. Document and provide to the owner a photo of the application, the name of the listed application, the date of installation, and the name of the installer.

H. The following table provides general guidelines for cable capacity for conduits that have no more than two 90º bends and are not longer than 100 feet. It is based on a maximum 40% fill and includes a de-rating factor of 15 % for each of the two 90º bends. The final conduit design shall be compliant with the Related References in Part 1. The radius of conduit bends shall be at least 10 times the conduit diameter. Under certain conditions where 10 times bend radius is not achievable due to structural conditions 6 times bend radius may be permitted by Owner.

Table 1 – Maximum Conduit Fill for Horizontal Cables Number of Cables or Wires

Wire O.D. mm	3.3	4.6	5.6	6.1	7.4	7.9	9.4	13.5
(in)	(.13)	(.18)	(.22)	(.24)	(.29)	(.31)	(.37)	(.53)
Conduit size								
1	8	8	7	6	3	3	2	1
1 ¼	16	14	12	10	6	4	3	1
1 ½	20	18	16	15	7	6	4	2
2	30	26	22	20	14	12	7	4
2 ½	45	40	6	30	17	14	12	6
3	70	60	50	40	20	20	17	7
3 ½	-	-	-	-	-	-	22	12
4	-	-	-	-	-	-	30	14

Note: Ensure that conduit/sleeve cable fill does not exceed specified fire-stopping methods.

3.4 Interbuilding Backbone Conduit Requirements

A. All conduits for backbone cabling shall be 4".

B. Conduits entering telecommunications or equipment rooms from below the floor shall be terminated not more than 4" above the finished floor.

C. Conduits for riser cables shall be continuous and separate from all conduit or enclosed raceway systems. Do not include more than two 90º bends between pulling points when installing riser conduits. Where junction

boxes are required, they must be hinged-type boxes and located in accessible areas, such as above suspended ceilings in hallways.

D. Factory bends are required for backbone conduit installations.

E. A 40” inch bend radius is to be maintained at all turns in.

F. A change in direction of the conduit run is not to be accomplished by adding a pull box.

G. Optical Fiber Cable shall utilize Interlocking Armored Cable, which is appropriately color coded, without the use of innerduct or max-cell.

H. Where shown or specified, install one (1) 1 1/4” inch plenum-rated inner duct for each optical fiber cable specified in all cable tray installations.

I. Label optical fiber inner ducts at each end within six feet of the rack and within one foot of entering or exiting a conduit, label shall be preprinted caution labels that indicate optical fiber cables and describe the size and the termination points of the installed cable. Labels must be yellow with black text and waterproof.

J. Install a single conductor locating wire of minimum 14-gauge solid insulated orange wire for all non-metallic optical fiber cables and terminate on cable’s FDU.

K. All multi-cell conduits and inner ducts and multi-cell inner duct shall be rated per NFPA 70 requirements.

L. Conduits entering the entrance, equipment, or telecommunications rooms from below grade shall extend 4” inches above the finished floor. Location of entrance conduits shall be within 12” inches of room corners.

M. Conduits shall be sloped downward from the building towards the manhole or handhole to prevent flooding in the building. Install a waterproof plug on each end of the conduit section.

N. Terminate conduits entering the entrance, equipment, or telecommunications rooms from above the ceiling extend the conduit 4” inches below the finished ceiling or 12” inches above the cable tray.

O. Entrance conduits shall be continued into the building and to the entrance, equipment, or telecommunications rooms. Securely fasten all entrance conduits to the building to withstand any cable placing operation.

P. If the entrance conduits exceed the 180º of total bends limitation, an Owner-approved sized junction box, manhole, or handhole.

Q. All conduits shall have a measured 1320 pull-strength mule tape installed and tied off at each end.

R. Install bushings at the endpoint of all conduit sections.

3.5 COMMUNICATIONS ROOM CABLE TRAY SYSTEM

A. TR cable tray shall completely wrap all walls within the room.

B. The cable tray shall extend over all equipment racks.

C. The cable tray shall be a minimum width of 18” inches or such width to support cables with a 60% growth allowance.

D. Typical cable tray installations will be at nine feet AFF or one foot above equipment racks.

E. Bond and ground cable tray system to equipment racks using manufacturer approved methods and products.

F. See section 2.8 Cable Trays - Ladder Type.

3.6 JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS

A. If the station conduit route exceeds the 180º of total bends limitation, an appropriately sized junction box is required within a straight section of the conduit run.

B. A junction box shall not be used in place of a bend. All junction boxes in station conduit paths shall be installed within a straight section of the conduit run.

C. Junction Box Requirements for Station Cables.

JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS			
Conduit Size	Size of Box		
	Width	Length	Depth
¾”	4”	4”	3.5”
1”	4-11/16”	4-11/16”	3.5”
1 ¼”	6”	6”	4”
1 ½”	6”	6”	4”
2”	8”	8”	4”
2 ¼”	12”	12”	6”
2 ½”	12”	12”	6”

3.7 FIRESTOP

A. Telecommunications pathways requiring fire-stopping shall utilize UL-listed re-enterable fire-stopping assemblies. See Section 2.11 Firestop (Hilti, STI, or Wiremold).

B. In all buildings, floor/ceiling assemblies, stairs, and elevator penetrations shall be sealed with a 2-hour fire stop assembly at a minimum, unless otherwise noted.

C. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire-rated construction is to be verified with Owner. All fire-stopping penetrations must be photographed and labeled with the UL1479 or ASTM E814 reference number, dated, and signed by the technician who installed the fire-stopping material. Submit firestop documentation to the Architect or Engineer before the final electrical inspection.

END OF SECTION

SECTION 27 05 43 UNDERGROUND DUCT AND RACEWAYS

PART 1 - GENERAL

A. The Contractor is held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation. The approved Contractor is held responsible to be familiar with the provisions contained herein and is assumed to possess the proper license(s), bonding, knowledge, manpower, and material needed for the completion of the design and installation.

1.1 WORK REQUIRED

A. The work required under this Section consists of providing all primary, secondary, telecommunications/data underground ducts and raceways, including manholes and handholes for the project as shown on drawings and/or as specified herein.

1.2 WORK REQUIREMENTS BUT SPECIFIED ELSEWHERE

A. Division 02 Site Improvements (is existing conditions)

B. Division 26 Electrical Systems

C. Install to the National Safety Code requirements when installing in public streets or right of way.

1.3 RELATED SECTIONS

A. Division 26 Electrical

B. Division 27 Communication Systems

C. Division 28 Electronic Safety and Security

PART 2 - PRODUCTS

2.1 GENERAL

A. The Exterior Telecommunications Pathways will provide a campus distribution system for all cabling that will be served by the building ERs (Entrance Rooms). Exterior pathways are required to connect new buildings or existing buildings with inadequate or obsolete entrance pathways to the campus telecommunications distribution systems. The pathways for a campus distribution system may include all or some of the following, maintenance holes, hand holes, inner ducts, and conduits.

1. The number, size, raceway duct material, and arrangement shall be as indicated on drawings and/or as specified herein.
2. All conduits shall minimally be 4” inches in diameter and can consist of schedule 40 construction if the concrete is encased.
3. All bends must be long, sweeping bends with ten times the internal diameter of conduits larger than (4” inches).
4. In underground raceways, angle couplings and bends alone or in combination with straight sections shall be used for direction changes; direction changes made by skewing straight sections of conduits will not be permitted. Any angle greater than 22° degrees shall be factory-made.
5. Orange locatable caution tape shall be installed in two rows 12” inches above all underground conduits.
6. Install a #14 stranded copper locatable wire with orange insulation in the trench or one open conduit. Mechanically secure the locate wire at all endpoints. When installing the locate route through more than one section, install the locate wire continuously through the route and terminate mechanically secure on each end.
7. Conduits may be non-metallic (PVC) or Rigid Galvanized Conduit heavy wall (RGC) conduit (as outlined in items B and C below) and indicated on Drawings and/or as specified herein.
8. Conduits shall be capped with manufactured caps (Duct Plugs) when installation is temporarily discontinued.
9. Conduits shall be cleaned by passing a wire brush mandrel and/or rubber duct swab (or approved alternative) of appropriate size back and forth until all foreign materials and water are removed.
10. Conduits shall be checked by pulling a round test mandrel, ¼ inch less than conduit size for each duct from both directions to remove obstructions.
11. Conduits shall be encased by a concrete envelope or as specified by the specifications, with a minimum 3 inches cover on all sides or flowable backfill as specified on the drawings.

12. Conduits shall be installed using long radius sweeps unless otherwise noted on Drawings or in the Scope of work. No more than 180° degrees of total bends in any one section of conduit.
13. Conduit runs shall contain no continuous sections longer than 350 feet. If runs total more than 350 feet, pull points (Manholes or Handholes) shall be inserted at the midpoint or as specified by the specifications.
14. Conduits shall be installed with a minimum of 6” inches of fall per 100 feet run toward manholes and away from buildings.
15. Conduits shall be provided with continuous 1250-pound tensile strength conduit measuring pull tape in each duct.
16. Conduits shall be inspected and approved for correct formations before tying to prevent ducts from floating when concrete is poured.
    a) Separate from power up to one KVA:
        1) 12” inches of well-packed earth
        2) 4” inches of masonry
        3) 3” inches of Concrete
    b) Separate from Gas, Oil, Water, etc.:
        1) 12” inches when parallel
    c) Separate 6” inches when crossing
17. A minimum of 30” inches of buried depth (measured from the top of the concrete encasement to the finished grade) is required. Exceptions may be granted to avoid conflicts of approval between the Architect/Engineer and the AHJ.

B. HDPE Directional Bored / Horizontal Drilling
    1. Typically two (2) - 4” HDPE Conduits should be installed or as specified by the Architect or Engineer.

C. Non-metallic Raceways
    1. PVC Type Schedule 40 with concrete encasement.
    2. The plastic duct shall meet NEMA TC-6 standards.
    3. The plastic duct shall be provided with straight couplings and PVC cement.
    4. Couplings shall be staggered horizontally and vertically.
    5. Use Schedule 40 for all raceways except where rigid conduit is required.
    6. Complete with the threaded adapter when attached to rigid steel conduit.
    7. Protected from deformation during stockpiling.
    8. Conduits shall be perfectly circular in shape. Other configurations will not be permitted.
    9. Joints and fittings shall be provided as per the manufacturer’s specifications and directions.
    10. Comply with manufacturers' requirements for bending and cutting.
    11. Joints shall be wrapped with Scotch #88 tape as a temporary concrete seal.
    12. Provide end bells flush with the inside wall of the manhole or vault.

D. Rigid Galvanized Conduit Heavy Wall
    1. As specified in Section 26 05 33 - Raceways, Boxes, and Fittings.
    2. All entrance conduits shall be rigid and also shall be used within the excavated portion of the building, including any areas where building excavation has or will be backfilled.
    3. Extended conduits 10 feet minimum from building into undisturbed earth.
    4. Use rigid conduits for all bells stubbed "in," or "out" or concrete bases for equipment housings.
    5. Use rigid steel conduits in areas of extended backfill, requiring maximum strength against shear.
    6. Use rigid steel conduits when crossing under tunnels.
    7. Use rigid steel conduits when crossing under a roadway.

E. Concrete Envelope
    1. Size where shown on drawings, with raceways receiving not less than 3 inches of Concrete cover all around and 1-1/2” inches between raceways.
    2. Provided support piers to undisturbed soil where necessary for permanent bearing.
    3. Provide 3000 psi, class 2, concrete ready mix per ASTM-94.
    4. Provide with fine sand cover for initial curing except where waived by the Architect/Engineer in writing.
    5. Rebar reinforcement is required where duct banks will cross roadways.

F. Backfill
    1. As specified Division 31 00 00 Earthwork (excavation, backfill, compaction, etc.).

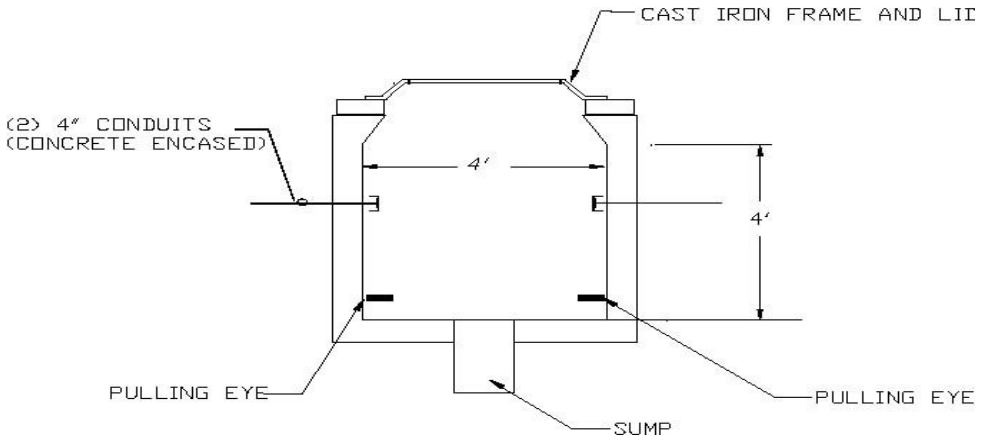
2.2 COMMUNICATIONS MANHOLES

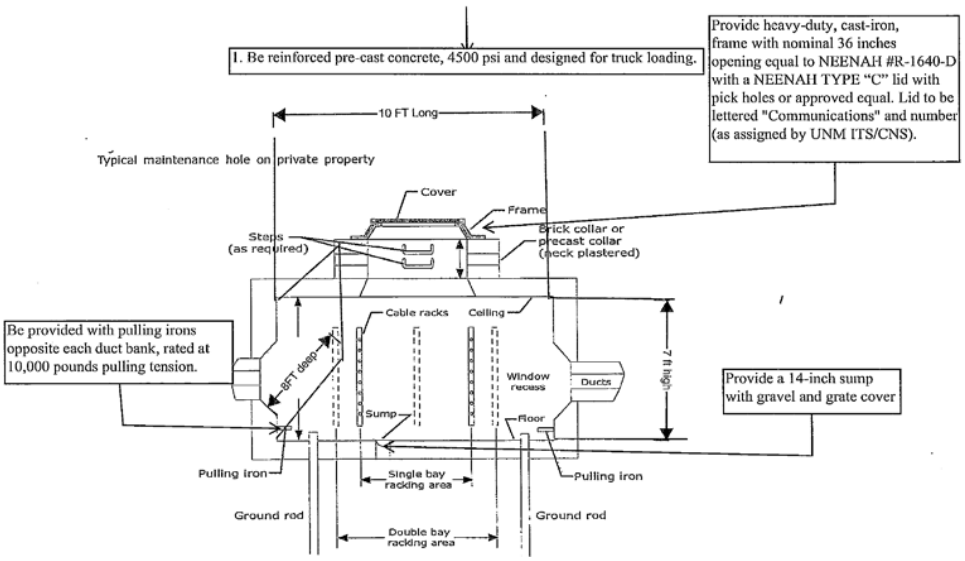
A. Manholes shall be as follows:
    1. Provided by Electrical or Telecommunications Contractor as described in the drawings and as specified herein.
    2. All Manholes and Handholes requirements must be approved by the Architect or Engineer.

3. Conduits shall enter and exit the manhole in a straight-line method. The remaining parallel walls are to remain free of conduit entrances. These walls shall remain free to allow cable support and splicing operations.
4. Shall be reinforced pre-cast concrete, approved by the Architect or Engineer, 4500 psi, and designed for truck loading.
5. Minimum sizing shall be 10 feet long by 8 feet wide by 7 feet high inside dimensions, unless otherwise approved by the Architect or Engineer, specified on the Drawings and/or as specified herein.
6. Be provided with pulling irons opposite each duct bank, rated at 10,000 pounds of pulling tension.
7. Be complete with bonding jumper to reinforcing steel in each section.
8. Pre-cast manholes have reinforcing steel bonded together and do not require an additional ground rod. Install a bonding ribbon horizontally around the top of the manhole and attached it to all cable racks and hardware. Continue installation vertically between bonding clamps so both the top and bottom halves are bonded together on each side. The bonding ribbon will be used to bond and ground all splice cases and hardware placed within the manhole.
9. All manhole hardware shall have a rubberized or hot-dipped galvanized finish. Provide heavy-duty, cast-iron, frame with nominal 36” inches opening equal to NEENAH #R-1640-D with a NEENAH TYPE “C” lid with pick holes or approved equal. The lid shall be lettered "Communications" and number (as assigned by the Architect/Engineer). Install locking inter cover from McGard to specification.
10. Provide 6” inch and 12” inch grade ring riser castings as required to elevate the cover to approximately 1” above the finished grade. The internal diameter of grade rings shall be not less than the internal diameter of the manhole cover frame. Verify with the manufacturer on availability. Custom-grade rings are acceptable upon prior approval from the Architect or Engineer. Cast-iron adjusting rings, Neenah #R1979 series or equal may be used to trim final elevations.
11. Set on leveled undisturbed earth with a minimum of 3 inches of granular fill under the entire manhole before setting. If the earth is disturbed during excavation, properly compact soil and provide (3”).
12. Manhole ladders are required for all manholes unless otherwise noted on Drawings and/or as specified herein.
13. Provide a 14” inches sump with gravel and grate cover.
14. Furnish and install manhole signage within the chimney including a manhole/handhole designator, the measured distance to the next hole or building,North designation, and direction to adjoining maintenance holes and building entry points. Signage shall be stamped metal attached to the chimney.

2.3 HAND HOLES

A. Hand holes shall provide the following:
1. Shall be provided for in the Electrical or Communications drawings and/or as specified herein.
2. Be reinforced concrete, H-20, 4500 psi, and designed for truck loading.
3. Be 4 feet by 4 feet by 4 feet high inside dimensions.
4. Provided with pulling irons opposite each duct opening.
5. Be provided with pulling irons opposite each duct opening.
6. The handhole Cover shall be NEENAH #R-1640-D, with pick hole, lid lettered "COMMUNICATIONS" and number assigned by the Architect/Engineer.
7. Provide 6” inch and 12” inches grade ring riser castings as required to bring the lid up to proper grade, and NEENAH #R-1979 rings for final adjustments. The internal diameter of grade rings shall be not less than the internal diameter of the manhole cover frame.
8. Set on leveled undisturbed earth with a minimum of eight (8) inches of (pea gravel) granular fill under the entire manhole before setting. If the earth is disturbed during excavation, properly compact soil and provide 8 inches concrete leveling pad under the entire manhole before setting.
   a) Examples of Handholes:





2.4 MICRO-DUCT

A. Outdoor micro-duct – All micro-duct shall be composed of all dielectric materials (except for armored version or locate wire where applicable). The micro-duct shall be suitable for underground conduit, direct buried, or aerial applications as appropriate. During installation, micro-duct cable ends and individual micro-ducts are to be completely sealed to prevent the ingress of contaminants, including water. Upon completion of micro-duct installation, all micro-ducts shall pass the standard pressure test and proof test per the manufacturer's recommended procedures. All unoccupied micro-ducts shall be capped on both ends with airtight/watertight end caps. Install micro duct to meet the manufacturer's specifications and instructions.

2.5 INNERDUCT

A. Innerduct shall be installed where required or shown on drawings, and as specified and approved by the Architect or Engineer. Each inner duct shall have a one-half inch pre-lubricated, woven, 1250-pound tensile minimum polyester tape made from low friction, high abrasion resistant yarns placed within the inner duct and secured at each end. Tape shall be printed with sequential footage markings for accurate measurements. Install a single conductor locating wire in the inner duct conduit with a 14-gauge solid orange insulated wire for all non-metallic optical fiber cables. Install a single conductor locating wire in the inner duct conduit with a 14-gauge solid orange insulated wire for empty inner ducts**.** Where interlock armored fiber is the approved optical fiber cabling choice inner duct is not required or approved for empty conduit installations.

2.6 DUCT PLUGS

A. Dura-line S-60 Wide Temp Foam Conduit Sealant Kit for all conduits either occupied or unoccupied.

B. Innerduct sealing plugs shall be used to seal all inner ducts and conduits used or unused per manufacturers' recommendations.

2.7 HANDHOLES - SPECIAL PURPOSE

A. Verify exact size and load requirements as shown with Architect/Engineer approval before specification and installation of any

.

PART 3 - EXECUTION

3.1 CABLE SUPPORT

A. The cable supports described on the drawings or herein are intended to assist the Contractor in obtaining a satisfactory job and shall be altered to fit job conditions.

B. In general, all cables in manholes shall be supported on 4 feet maximum centers for straight runs, on each side of splices, and within 2 feet of cable entering or exiting a duct or termination.

3.2 EXCAVATION: Coordinated with other trades.

A. Verify all utility elevations and utility locations. Notify NM One Call (dial 811).

B. If soil conditions are such that because of the depth or any other reasons the trench/excavation cannot conform to the size of the duct bank, provide forms and bracing as required.

C. The contractor shall open the entire length of the trench and establish proper grades before beginning installation of any portion of connecting duct runs.

D. Per Division 02 00 00 - Excavation, Backfill, Concrete, Asphalt Repairs, and Related Work.

E. The depth of excavation shall be such that the required bury depths (top of concrete encasement) are met. The Architect or Engineer shall approve any deviation from the required depths before installation.

3.3 CONCRETE ENVELOPE

A. Protected against freezing, etc., as required in General Construction Specifications.

B. Install concrete so no honeycombing occurs and be properly vibrated with a small vibrator. Do not vibrate between ducts.

C. Size where shown on drawings, with raceways receiving not less than 3 inches of concrete cover all around and 1-1/2" between raceways.

D. Concrete for the duct bank shall be placed in such a way that the duct bank will not be disturbed and that the sides of the trench do not crumble, using splash boards, proper placement, etc.

E. Concrete shall be poured continuously from manhole to manhole. No pours shall originate between manholes.

F. The interval between the base or intermediate spacers shall not exceed 8 feet with a minimum of two supports per length of duct.

G. Make provisions, such as nylon ties, to prevent the ducts from floating when concrete is poured.

H. The color of the top layer of concrete encasement shall be “ORANGE” (for telecommunications) chalk dust while still wet, or dye the concrete.

3.4 REINFORCING

A. Shall be installed:
1. Where noted on contract drawings and /or as specified herein,
2. Where crossing trenches for other work,
3. Where connected to buildings and manhole walls, anchored thereto with projecting re-bars shall be installed,
4. At conduit joints,
5. If the continuous pour is impractical, provide (4) #4 reinforcing bars extending 6 feet into the first and second pour,
6. Where trenches cross roadways,
7. Reinforcing shall be supported from the bottom of the trench at least one inch and is not required if conduits are supported by saddles.

3.5 BACKFILL

A. Not be installed until after concrete has reached the initial set.

B. Per Division Earthwork (excavation, backfill, compaction, etc.).

C. The Contractor shall restore the landscape to its original condition.

3.6 AS-BUILDS

A. Contractors shall provide as-built information to the Owner before final payment for this work.

B. As-built information shall be in electronic (AutoCAD) drawings. Indicate the location of all underground routes.

3.7 DIRECTIONAL BORING

A. **Boring Depths -** Coil able duct shall be directionally bored at standard burial depths of 36” of cover for ducts housing primary cables and 24”-36” of cover for ducts housing secondary cables. The Architect/Engineer shall approve any exceptions in writing to the specified burial depths, up to a maximum 60” of cover from the final grade.

B. **Coil-able Duct Specification -** In areas where surface obstructions make standard open trenching undesirable or cost-prohibitive, directionally boring a coil-able duct provides a viable option to the Owner with approval from the Architect/Engineer. The coil-able duct shall be high-density polyethylene (HDPE) orange in color, with sizes of 3”, 4”, or 5” nominal inside diameter, as specified on the Drawings. The Architect/Engineer specifies the following for coil-able ducts:

3” SDR-13.5 (0.259” min. wall) per ASTM D1248
4” SDR-13.5 (0.333” min. wall) per ASTM D1248
5” SDR-13.5 (0.413” min. wall) per ASTM D1248

C. **Duct Joining -** Sections of the duct shall be joined using fusion couplings. Where the coil-able duct is to be joined with PVC conduit, the Contractor is to fuse a 24” straight piece of matching-size PVC conduit to the coil-able duct. Before fusing, the Contractor shall make circumferential scores around the outside of the PVC conduit at the end that is to be installed into the fusion coupling. This will allow the fusion coupling to adhere to the dissimilar PVC conduit. A special epoxy is also available that joins the coil-able duct with standard PVC couplings. The Contractor shall confer with the Architect or Engineer about epoxy.

D. **Vertical and Horizontal Bends -** All vertical bends shall be made using Schedule 40 PVC bends with belled or coupled ends as specified. Under no circumstances shall a vertical bend be fabricated by “sweeping” it up to grade using the guided boring machine.

E. **Connections into Vaults and Manholes -** Bored coil able duct Outdoor micro-duct – All micro-duct shall be composed of all dielectric materials (except for armored version or locate wire where applicable). The micro-duct shall be suitable for underground conduit, direct buried, or aerial applications as appropriate. During installation, micro-duct cable ends and individual micro-ducts are to be completely sealed to prevent the ingress of contaminants, including water. Upon completion of micro-duct installation, all micro-ducts shall pass the standard pressure test and proof test per the manufacturer’s recommended procedures. All unoccupied micro-ducts shall be capped on both ends with airtight/water-tight end caps. Outdoor micro-duct specifications are as follows (HDPE) shall end 4’-5’ feet from a new vault or manhole. This coil-able duct shall then be transitioned to a workable size PVC before connecting to the structure. The transition to PVC shall be made using the techniques described in Duct Joining.

END OF SECTION

SPECIFICATION 27 05 53 IDENTIFICATION FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the labeling of the telecommunications infrastructure as described on the Drawings and/or required by these specifications.

B. The University intends to create a Class 3 system of administration as per current ANSI/TIA/EIA 606 Standards. As such, all elements must be labeled with unique identifiers as described in the following sections. Labels shall be color coded as per TIA/EIA 568 Standards.

C. This section includes minimum requirements for the following:
   1. Labeling Communications Cabling
   2. Labeling Closet Hardware
   3. Labeling Work Stations

1.2 RELATED SECTIONS

27 05 28.2	PATHWAYS
27 11 16	CABINETS, RACKS, FRAMES, AND ENCLOSURES
27 11 19	TERMINATION BLOCKS AND PATCH PANELS
27 13 13	COPPER CABLE SPLICING AND OUTSIDE PROTECTED TERMINATIONS
27 13 23	FIBER OPTIC BACKBONE CABLING
27 15 23.2	FIBER OPTIC HORIZONTAL CABLING
27 15 43	FACEPLATES AND CONNECTORS

PART 2 - PRODUCTS

2.1 LABELS

A. The size, color, and contrast of all labels should be selected to ensure that the identifiers are easily read.

B. All labels are to be mechanically printed, no hand-printed labels are allowed for any component.

C. Labels should be visible during the installation of and normal maintenance of the infrastructure. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat, or ultraviolet light) and should have a design life equal to or greater than that of the labeled component.

D. Provide vinyl substrate with a white printing area and black print. If the cable jacket is white, provide a cable label with a printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.

E. Labels shall be flexible vinyl or other substrates that apply easily and flex as cables are bent.

F. Labels shall use aggressive adhesives that stay attached even to the most difficult jacketing.

PART 3 - EXECUTION

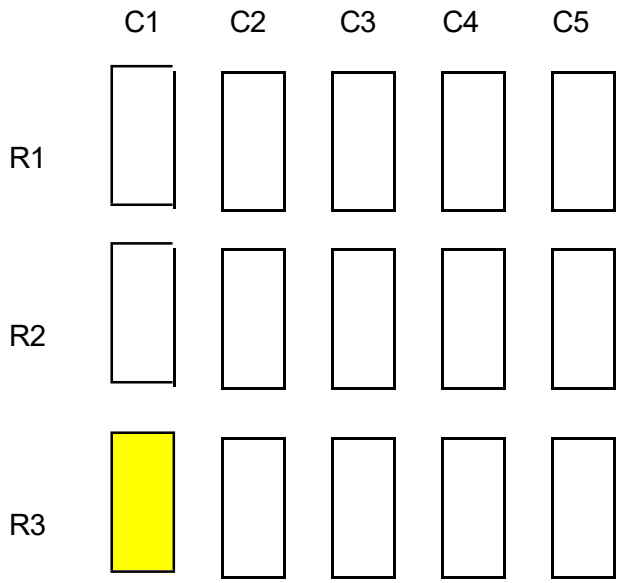
3.1 LABELING INSTALLATION

A. Horizontal Copper Cable Labeling:
   1. All horizontal cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, Rhino, or equivalent labeling system. Identification shall be as follows:
   2. At the TR end, the cables shall be labeled with the location of where the other end of the cable is terminated including room number, TO number, and jack position. Place a label on a visible part of the cable within 6 inches of the termination point for ease of identification after termination.
      a. Example: Two cables going to room 114, first TO, first jack position would be labeled as 114-1A1. The second cable in the second TO, and the third jack position would be 114-2A3.

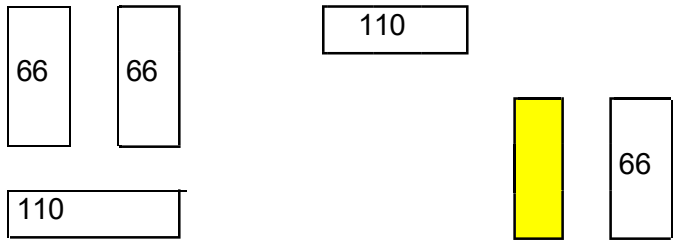
Cable	1	114-1A1	

Cable	2	114-2A3	

3. At the TO end, the cables shall be labeled 4 inches from termination with the following: Data. TR. Rack. Patch Panel. Port. This shall be visible by removing the outlet cover plate.
   a. Example: Data, TR Room 114, rack 1, patch panel 1, port 03 would be: D.114. 1.1.03.
   b. For voice cabling in an older building with separate voice closets and no patch panels, include the TR and as much information as practical such as column, row, block number, and port number or pairs.
      1) Example: TR room 105, on a 66 block in the first column, third row down, port 4 would be: V.105.1.3.04



      2) Example: TR room 105, no discernable pattern of columns or rows or ports, and/or mixed environment of 110 and 66 blocks, the label could be: V.105.E wall.24/25.



4. For CATV coaxial drop cables, at the splitter or tap, the cables shall be labeled with the location where the other end of the cable is terminated including room number, TO number, and jack position. If not collocated with a TO, indicate the room number at a minimum. Place a label on a visible part of the cable within 12 inches of the termination point for ease of identification after termination
   a. Example: A cable going to room 114, first TO, sixth jack position would be labeled as C.114.1A6.
   b. Generally speaking, coaxial cables will be in the sixth position when collocated with a standard TO.
5. For coaxial cables at the TO, they shall be labeled 4 inches from termination with the words “From Room” and the room number where the splitter or tap is. This shall be visible by removing the outlet cover plate.
   a. Example: Room 115 would simply be: From Rm. 115.

CATV	From Rm 115	

B. Telecommunications Outlet (TO) Labeling Scheme:
   1. TO’s are labeled alphanumerically in a clockwise rotation around the room. Typically, the first TO located to the left of the main entrance of the room is labeled 1A, followed by 2A, 3A, etc. Where two entrances are present, designate one as the main entrance and label it accordingly.

a. The intent is to have unique identification for each TO. The starting point and nomenclature of the TOs are irrelevant to the location inside the room.

2. Floor box TOs shall be prefaced with “FB” to read FB1A, FB2A, etc. Wireless Access Point TO’s in ceilings are to be prefaced with “WAP” to read WAP1, WAP2, etc. Elevators shall be prefaced with “Elev” to read Elev1. Audio Visual Projectors are to be prefaced with “AV” to read AV1.
3. On subsequent TO installations, the TO will be labeled alphanumerically depending on the new TOs location. If the new TO is between 1A and 2A, the new TO would be labeled as 1B. If another one is later added between 1B and 2A, it would be labeled 1C. If it is after the last TO in the room, 3A, it would be labeled:

4. Seek clarification from UNM IT for any labeling issues that arise.

C. Faceplate Labels:
1. Faceplates will be labeled using the plastic insert to cover a printed identification tag. Each of the 2 labels in a faceplate is meant to have 2 lines for a total of 4 individual lines per faceplate.
2. The TO label will vary slightly depending on whether a unified cabling platform is used where all cables go to one TR, or separate voice and data closets are used.
3. See addendum 1 for an example of the UNM IT labeling on a faceplate.
4. See addendum 2 for an example of the UNM IT labeling on a faceplate with unified cabling.
5. See addendum 3 (1) for an example spreadsheet in MS Excel with dimensions for the labels.
   a. Line 1 contains the preface “D” for Data, the specific TR, rack, patch panel, and the range of ports used for termination. In the case of separate voice and data closets, only the data information is conveyed here.
      1) Example: For cables going to TR Room 114, rack 1, patch panel 1, ports 3-5, line 1 would read: D.114.1.1.03/05.
   b. Line 2 also contains information regarding where cables are terminated in the closet, but is used for subsequent cable installations to that specific TO.
      1) Example: Another 3 cables were added to the same TO at a later date. For cables that go to TR Room 114, rack 3, patch panel 3, ports 22, 23, and 24, line 2 would read: D.114.3.3.22/24
   c. Line 3 is only used if separate voice and data closets are being used. Line 3 contains the preface “V” for Voice, the TR, and the TO number and jack position.
   d. Line 4 is the unique identifier for the TO.

D. Horizontal 110 and 66 Block Labeling for voice:
1. For 110 blocks, if the cables are for room terminations label the space for the port with the room number, TO, and jack position.
   a. Example: A cable going to room 114, first TO, first jack position would be labeled as 114-1A1. A cable in the second TO, and third jack position would be 114-2A3.
2. For 66 type blocks, if the cables are for room terminations tag the cable with the room number, TO, and jack position with a loose paper tag with a string that is easily accessible and readable.
   a. Example: A cable in room 114, first TO, first jack position would be labeled as 114-1A1. A cable in the second TO, and third jack position would be 114- 2A3.
3. If the 110 block is for the tie cable between the voice patch panel in the rack and the wallboard, label the space corresponding to the port with the rack, patch panel, and port information as per section 4.01.E.2. For tie cables between the rack and wallboard a 110 block shall be used.
   a. Example: Rack 1, patch panel 1, would be: Rack1 Voice PP1.
   b. See addendum 3 (2) for an example label.

E. Patch Panel Labeling:
1. For station cabling going to a TO, label each port on the patch panel with the room number, TO, and jack position.
   a. Example: A cable in room 114, first TO, first jack position would be labeled as 114-1A1. A cable in the second TO, and third jack position would be 114- 2A3.
2. Example: A cable going to a floor box TO labeled FB1A in room 114 in the second jack position would be labeled as 114-FB1A2 For voice patch panels connected to a 110 block within the TR, label each port on the voice patch panel with the corresponding 110 block source information as per section 4.01.D.3.

a. Example: A 110 block in the first column, third row down, port 4 would be: 1.3.04
3. Due to the amount of space allocated for TO designation on patch panels, place the room number on top and TO on the bottom.
   a. See addendum 3 (3) for an example label.

F. Equipment Room:
1. Equipment Racks shall be labeled with a one-inch self-laminating marking tape, Brady ID-Pro labeler, Brother P-touch labeler, Rhino, or equivalent labeling system at the base of the rack. Starting in front of the equipment rack, left to right, identification shall be as follows: Rack 1, Rack 2, and Rack 3.
2. All patch panels shall be labeled with a 3/8 inch self-laminating marking tape, Brady ID-Pro labeler, Brother P-touch labeler, or equivalent labeling system. Starting from top to bottom in sequence. Place the label on the left side of the patch panel vertically, identification shall be as follows: PP 1, PP 2, PP3, and so on.

G. Vertical/Riser/Intrabuilding Copper Cable Labeling:
1. All riser cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, Rhino, or an equivalent labeling system.
2. At the TR, the copper riser cables shall be labeled with from/to, cable count, and pair information on both ends. Place a label on a visible part of the cable close to the wiring block for ease of identification after termination.
   a. Example: From ER B065 to TR 114, first of 2, 100 pair cables would be: ER B065 to TR114 1-100. The second 100-pair cable between the rooms would be ER B065 to TR114 101-200.
3. Label cabling on each side of wall penetrations.

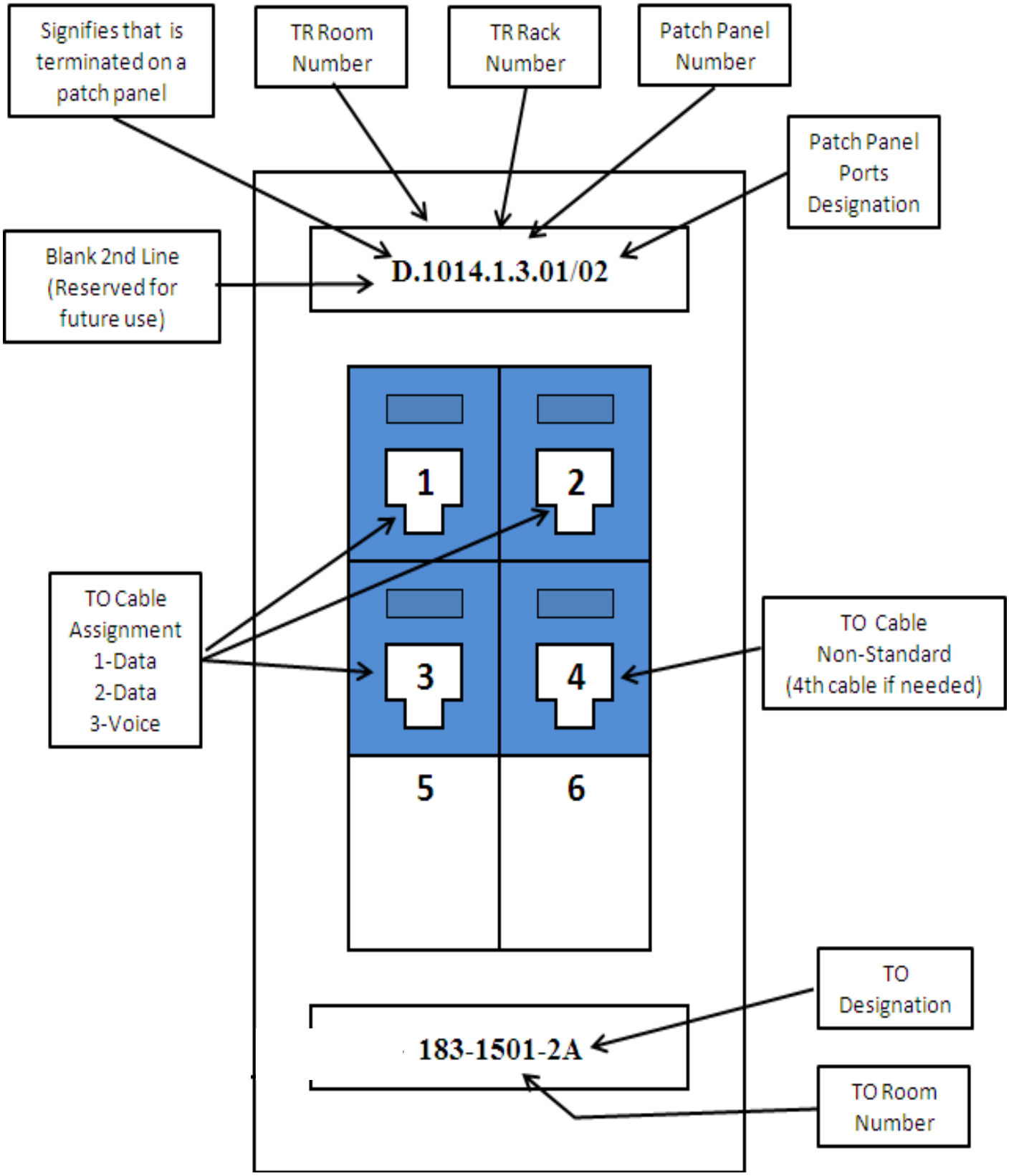
H. Vertical/Riser/Intrabuilding Fiber Cable Labeling:
1. All riser cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, or equivalent labeling system. Identification shall be as follows:
2. At the TR, the fiber riser cables shall be labeled with from/to, fiber type, and fiber count on both ends. Place a label on a visible part of the cable and innerduct close to the fiber distribution unit (FDU) for ease of identification after termination.
   a. Example: From ER B065 to TR 114, the first cable would be: ER B065 to TR114 24SM/24MM.
   b. If a second fiber bundle between the rooms is installed with the same fiber count, place an (F2) and the end of the label.
      1) Example: From ER B065 to TR 114, the second cable, would be: ER B065 to TR114 24SM/24MM. (F2)
3. Label cabling on each side of wall penetrations.

I. Vertical/Riser/Intrabuilding 110-Block Labeling:
1. At the ER and TR, voice riser cables are terminated on their respective 110 blocks. Label each pair on each row of 110 blocks with the matching pair count information.
2. Place the entire cable label of “from/to” in the center of the 110 block label as per section 4.01.G.
3. See addendum 3 (4) for an example label.

J. Coax Trunk Labeling (CATV):
1. CATV coaxial trunk cables shall be labeled at each termination point with information indicating the location of the next termination point of the cable, such as an amplifier, DCT, splitter, or tap.

K. Vertical/Riser/Intrabuilding and Campus Fiber FDU labels:
1. Labels shall indicate the type of fiber (single mode or multi-mode 50µm or 62.5 µm), “from/to” information, pair count, loss for each strand, and length of cable.
2. See addendum 3 (5) for an example label.

L. Interbuilding/Campus/Backbone Copper and Fiber Cable Labeling:
1. All interbuilding cables shall be labeled permanently with “from/to” information, cable type and size, installation date, and installing contractor at each end.
   a. Example: From Bldg. 256 to Bldg. 203, a 200-pair copper cable, installed by Lobo Enterprises on September 22, 2008, would be: From Bldg. 256 to Bldg. 203 (200 Pair) Lobo Enterprises 9/08.
   b. An as-built is to be provided to Owner of which manhole and pull-boxes the cable passes through. Provide butterfly drawings after installation is complete.



END OF SECTION

SECTION 27 08 00 COMMISSIONING AND ACCEPTANCE

PART 1 - GENERAL

A. This section intends to establish complete service requirements for inspection, testing, verification, and documentation of telecommunications infrastructure, cabling, and equipment following these specifications and applicable Owner requirements and codes.

B. This specification includes requirements for all types of commissioning including continuous commissioning, milestone monitoring, acceptance commissioning, third-party verification, internal commissioning, acceptance, and network operability, depending upon the project's requirements.

C. It includes the commissioning of all types of telecommunications infrastructure work including but not limited to structured cabling systems, network analysis, optical fiber cabling systems, coaxial cabling systems, outside plant cable, duct banks, multiduct, trenches, maintenance holes, and aerial pole line distribution.

D. The Contractor, designated agent, or employee is held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation.

1.1 SCOPE OF WORK

A. All services will be contracted and will be considered to be part of the project scope and budget. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and test equipment unless otherwise specified to verify compliance.

1.2 QUALIFICATIONS

A. The Contractor shall send only fully qualified personnel to perform work under this section of work.

1. The contractor shall have a fully qualified (RCDD or equivalently qualified) IT Commissioning Agent overseeing operations for the project.

2. Any licensing requirements shall be fulfilled for all work.

3. The Contractor shall provide, a complete list of personnel proposed to perform the work, listing their qualifications and experience with the type and size of work required by the project.

4. Each Technician, Journeyman, and Equipment Operator will have a minimum of five (5) years of experience with all applicable telecommunications systems.

5. The commissioning agents shall be certified by the manufacturer of the testing equipment used to perform the commissioning of the project.

PART 2 - PRODUCTS

2.1 PRODUCTS STANDARD

A. All work performed and commissioned shall be done following the most current version and requirements of the following references:
1. Division 26 Electrical Division
2. Division 27 Communications Systems
3. Division 28 Electronic Safety and Security
4. BICSI Wireless Design Manual
5. BICSI Customer-Owned Outside Plant Design Manual
6. BICSI Telecommunications Distribution Design Manual
7. TIA Standards: 568, 569, 607, 758
8. National Electrical Code.
9. National Electrical Safety Code
10. Related NFPA Codes and Standards
11. Underwriters Laboratories or approved Testing Lab.
12. The manufacturer's specifications, installation, and warranty requirements.
13. The project plans and specifications.

PART 3 - EXECUTION

3.1 COMMISSIONING CONTRACTOR REQUIREMENTS

A. **The IT Commissioning Contractor must be approved by the Owner to provide this service for communications projects both on and off project site.**

B. The Owner owns, operates, and maintains copper and optical fiber cable distribution systems, structured cabling systems, infrastructure, and networks serving project site. The Owner's building consists of voice and data networks, structured cabling systems, copper and optical fiber inter and intra- building cabling and infrastructure systems, wireless, voice, and data systems, and other support facilities.

C. Because of the nature of many of the occupancies in the buildings, the efficient operability of voice and data networks is critical to the operations. The efficiency of voice and data networks cannot be verified until the network is operating at its highest potential or has undergone complete testing and verification under the Commissioning Specification Standard, third party verification and acceptance of voice and data facilities are necessary to provide guarantee of a system's optimal performance.

D. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, test equipment, deficiency reports, and other requirements specified in the project plans and procurement documents.

E. The cabling Contractor shall provide any field and verification reports, photographs, test reports, inspections, punch list, or other items and documentation identified in this section as requested by the Owner.

F. The Contractor shall have the ability to provide complete testing and verification capabilities.

G. All test equipment shall be certified, and calibrated to meet manufacturers' requirements and meet the performance requirements of Underwriter's Laboratories (UL), ETL – SEMKO, the manufacturer's systems specifications/requirements, and most current TIA/EIA standards as it applies to the specified testing application.

H. Each Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.

I. All work performed in occupied spaces shall be in a manner that allows the owner to operate the existing facilities continuously.

J. All user outages, including wireless access points, shall be submitted to the Owner/Architect for approval two weeks before starting work that will affect user connectivity.

K. The Contractor is required to obtain all permits from the proper jurisdictions for all work associated with this specification.

L. The Contractor is to provide to the Owner all reports, documentation, and test results at substantial completion in an approved format.

M. All work performed or verified must be compliant with the Owner's Guide Specifications, and Design Guidelines and follow the installed product's manufacturer's instructions and procedures.

N. The Owner shall provide technical assistance in identifying/specifying commissioning and testing requirements as they pertain to the specific project.

O. The Owner will provide access to the buildings, premises, or facilities. In addition, the Contractor may obtain keys to the buildings and certain areas within them on an "as-needed" basis from the Owner. The Contractor is responsible to obtain all training and badges required to perform the work.

P. The Commissioning Contractor shall arrange directly with the project's contractors for site access not controlled directly by the Owner. The Owner will assist the Contractor in obtaining access to these areas when needed.

Q. The Owner will assist in obtaining entry/access to equipment rooms, tunnels, and facilities.

R. The work under this contract shall consist of furnishing materials; test equipment and qualified labor to test, evaluate and document communications layer one system throughout the IT system.

S. The Commissioning Agent shall provide certified structured cabling system technicians on-site to perform operations related to the testing and evaluation.

T. The Contractor is to commit to all listed and applicable standards including current Technical Service Bulletins (TSBs) and addendums.

U. The Commissioning Agent shall deliver the following test and reports as specified in the work order for the project:
   1. Provide Field Verification and Deficiency Report(s), photographs, and installation evaluations of the structured cabling system's infrastructure and spaces. Verify to the most current versions of ANSI/TIA 569, the Specifications and References, Standards, the National Electrical Code, applicable codes/ordinances, the structured cabling manufacturer's warranty requirements, the infrastructure system's manufacturers specifications, and the project specification and drawings.
   2. Provide Field Verification and Deficiency Report(s), photographs, and installation evaluations of the structured cabling. Verify the most current versions of ANSI/TIA 568, the Specifications and References, Standards, test using the TIA 568 link performance requirements, the National Electrical Code, applicable codes/ordinances, the structured cabling manufacturer's warranty requirements, the cabling systems system's manufacturer's specifications, and the project specifications and drawings.
   3. Provide Field Verification and Deficiency report (s), photographs, and installation evaluation of the grounding and bonding system to TIA 607, Specifications and Guidelines, the National Electric Code specification, and drawings. Include verification of ohms of resistance at all ground bars.
   4. Provide Field Verification and Deficiency report (s), photographs, and installation evaluation of labeling for installed systems, infrastructure, facilities, and equipment according to the manufacturer's warranty requirements, specifications and guidelines, and the project's specification and drawings.
   5. Provide Network Verification and Deficiency report (s), including but not limited to: Network Service Availability, Ethernet Utilization and the presence of network error, port identification, verify link connectivity, verify Power Over Ethernet, service activation documentation, troubleshooting link and, and other network performance and documentation testing as per the manufacturer's specifications or as specified.
   6. Provide Field Verification and Deficiency report (s), photographs, and installation evaluation of the outside plant copper and optical fiber cable, facilities, and infrastructure to EIA/TIA 758 BICSI Customer Owned Outside Manual Plant Manual, specifications and guidelines, the National Electrical Code, National Electrical Safety Code, applicable codes/ordinances, the structured cabling systems manufacturers warranty requirements, the infrastructure system's manufacturers specifications, cable systems manufacturers specifications, and the project specification and drawings. Include the following in-field verification.
      a) Neat and workman-like manner
      b) Installation evaluation
      c) Placement
      d) Conduits and seals
      e) Multiducts
      f) Labeling
      g) Trench
      h) Copper cable
      i) Optical Fiber cable
      j) Splices – bonding, color coding, neatness, fold back, etc.
      k) Splice cases instructions
      l) Manholes and apparatus
      m) Pole setting and hardware
      n) Grounding and bonding
      o) Waterproofing compound
      p) Cleanup & Restoration
   7. Provide Field Verification and Deficiency report(s), photographs, and installation evaluation of fire-stopping.
      a) Verify proper use of listed applications to applicable codes
      b) Verify photographs
      c) Verify labeling
      d) Verify submittals
   8. Testing of the Optical Fiber
      a) Test to all TIA/EIA specifications on all wavelengths.
         1) TIA-526-7 for single mode fiber
         2) TIA-526-14 for multimode fiber
   9. A test sample of structured cabling. Include in reports all test results, not only pass/fail using the current Fluke tester and software.
      a) Category 6-testing as specified and providing test equipment specified and/or approved by the Owner or the Architect/Engineer.

b) Category 6 Augmented F/UTP – testing as specified and providing test equipment specified and/or approved by the Owner or the Architect/Engineer. Comparison of sample testing to contractor test results

10. Provide testing of outside plant copper cable pairs and grounds including:
    a) Line mapping result: Pass/Fail
    b) Proper wiring configuration for cable pairs and bundles
    c) Open conductors – provide
    d) Footage for failures
    e) Split pairs
    f) Reversed pairs
    g) Shorts – provide ohms & provide loop resistance in ohms
    h) Grounds – provide ohms & distance to fault on failures
    i) Crossed pairs
    j) Sheath and ground rod resistance test in ohms
11. Provide all test results in the following format.
    a) Two (2) – paper copies bind in notebook form
    b) Two (2) – electronic formats on a Thumb drive
    c) Provide test results in EXCEL Format
12. Evaluate project drawings and specifications to determine and report deficiencies in the design.
13. Verify red lines (as-builts to submittals) to installation to determine and report deficiencies.

V. Scheduling: Work performed under this Contract shall usually be performed during normal working hours (8 A.M. to 5 P.M.) and on normal working days, Monday through Friday, unless otherwise specifically requested and authorized by a duly designated agent of the Owner (See paragraph F. below). The contractor shall make every attempt to schedule the work so as not to interfere with the operations of the affected project, department, or user(s).

W. Designated agent/designee: The name(s) of such duly designated agent(s) shall be supplied to the Contractor within ten (10) days after the date of Contract award.

X. Work request: The Contractor shall be authorized to perform work through the issuance of a Work Order, executed proposal, or other written order issued by the duly designated agent(s) of the Owner. The order will specify the work location and a general description of the problem or work to be performed. The designee will also provide a briefing on the work to be performed. A copy of the work order authorization, reports, photographs, and drawings must be submitted with any invoice for payment and must be signed/authorized by the Owner.

Y. Emergency Response: If the work is classified by the Owner’s designee as an "Emergency Request", such work will be scheduled by the Contractor at once and shall automatically authorize the Contractor to perform overtime work if the work must be performed during non-standard working hours. Response to "Emergency Work" shall be immediate and shall be handled following this paragraph and the General Conditions.

Z. Identification; while working on site, all of the Contractor's employees are to wear identification cards in addition to uniforms, badges, etc. as required by the Owner, indicating the Company and preferably the employee’s name. The commissioning agent and their representatives shall be attired professionally with the company’s name and logo.

AA. The Commissioning Agent and their representatives shall provide all personal protection equipment as required by the project.

END OF SECTION

SECTION 27 10 05 STRUCTURED CABLING FOR VOICE AND DATA - INSIDE-PLANT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cabling and pathways inside building(s).

B. Distribution frames, cross-connection equipment, enclosures, and outlets.

C. Grounding and bonding the telecommunications distribution system.

1.2 RELATED REQUIREMENTS

07 84 00	FIRESTOPPING
26 05 26	GROUNDING
26 05 33	RACEWAYS, BOXES, AND FITTINGS
26 27 26	WIRING DEVICES AND PLATES

1.3 ACRONYMS

A. AFF: Above Finished Floor.

B. AMEP: Architectural, Mechanical, Electrical and Plumbing.

C. BDF: Building Distribution Frame.

D. Cat: Category.

E. CATV: Community Antenna Television (cable television).

F. EMI: Electromagnetic Interference. EMI is radiated or conducted electromagnetic energy that has an undesirable effect on electronic equipment or signal transmission.

G. HH: Hand Hole.

H. IDC: Insulation Displacement Connector.

I. IDF: Intermediate Distribution Frame.

J. LAN: Local Area Network.

K. MH: Man or Maintenance Hole.

L. NEC: National Electrical Code.

M. PBX: Private Branch Exchange (Phone Switch).

N. PB: Pull Box.

O. PVC: Polyvinyl Chloride.

P. STP: Shielded Twisted Pair.

Q. TO: Telecommunications Outlet.

R. TR: Telecommunications Room.

S. UTP: Unshielded Twisted Pair.

1.4 DEFINITIONS

A. Plenum Cable: Listed for use in air-handling spaces.

B. Bonding Conductor: An insulated copper conductor that bonds the telecommunications main grounding bus bar to the service equipment (power) ground.

C. Telecommunications Bonding Backbone (TBB): An insulated copper conductor that bonds all telecommunications grounding busbars to the telecommunications main grounding bus bar.

D. Telecommunications Bonding Backbone Interconnecting Bonding Conductor – An insulated copper conductor that bonds two or more telecommunications bonding backbones together in a multi-story building.

E. Telecommunications Grounding Busbar (TGB): A copper ground busbar installed in every TR and is bonded to the telecommunications main grounding bus bar by the telecommunications bonding backbone. All metallic items in the telecommunications rooms are connected to the telecommunications grounding busbar.

F. Telecommunications Main Grounding Busbar (TMGB): A copper ground bus bar installed in the building distribution frame and is bonded to the service equipment (power) ground by the building conductor. This serves as a dedicated extension of the building grounding electrode system for telecommunications.

G. Building Distribution Frame (BDF): A frame designated as the point where the outside Utility Service cable terminates on the building entrance terminal (first level backbone). These Building entrance terminals include provisions for optical fiber/twisted-pair cabling coming from the campus telephone switch facility where the main distribution frame (MDF) is located.

H. Intermediate Distribution Frame (IDF): A frame, rack or termination block that connects to the building distribution frame with copper and optical fiber riser cables and distributes horizontal wiring to the rooms (second level). In some situations, a building distribution frame may also serve this function.

I. Telecommunications Outlet: The standard telecommunications outlet is a connecting device in the work area on which horizontal cable or outlet cable terminates. This outlet is typically provisioned with three ports (maximum capacity is six ports) of either Category 6 or Category 6E Augmented cables and typically terminates in a designated Telecommunications Room (TR) at an intermediate distribution frame patch panel. (CAT 6E is required for this project)

J. Protector: A device used to protect facilities from and equipment from abnormally high voltages or currents.

K. Utility Service: Electrical power, telecommunications, CATV or other infrastructure sources provided external to the building, facility, location, or site.

L. Riser Cable: Telephone, data, video, coaxial and other structured cabling system cables extending vertically (or horizontally, in some cases) between the BDF and each area IDF to support low voltage systems.

M. Horizontal Cable: The cabling between and including the work area telecommunications outlet/connector and the horizontal cross-connect/patch cord in the telecommunications room. This is typically a Category 6 or 6E Augmented 4 pair cable but can also include multiple fiber cables for the desktop, coaxial cables and other multi-media type cables that provide service to an end user device. (CAT 6E is required for this project)

N. Utility Service Building Cable: Outside plant cable or infrastructure connecting two or more buildings together for the distribution of telephone, data, video, or control signals.

O. Building Cable: Inside cable plant or infrastructure within a building for the distribution of telephone, data, video, or controls signals.

P. Approved / Approval: Written permission from the Owner to use a material or system.

Q. Should: Denotes a recommended practice, procedure, means or method.

R. Shall: Denotes a required practice, procedure, means or method.

S. Backbone Cabling: Cabling and connecting hardware that provides interconnections between telecommunications rooms, equipment rooms, and entrance facilities.

T. Backbone: A pathway, cable or conductors between telecommunications rooms, or floor distribution terminals, the entrance facilities and equipment rooms within or between buildings.

U. Connector (Jack): A female telecommunications connector that may be keyed or un-keyed and may have six or eight contact connector that may be positions, but not all the positions need to be equipped with jack

contacts. Jacks are typically used to terminate cable at the user end and are inserted into faceplates to create a connection point for the user's equipment cord.

V. Equipment Room (ER): An environmentally controlled centralized space for telecommunications that houses a main or intermediate cross-connect. An equipment room can contain equipment to support all of the following: entrance protection, cable infrastructure pathway, data and voice services, PBX, demarcation point, wireless, paging, fire /smoke detection, security alarm systems, radio, area of rescue assistance equipment, CATV and video conferencing.

W. Furnish: Supply and deliver to owner at the location of installation.

X. Install: Mount and connect equipment and associated materials ready for fully functional use by the owner.

Y. Private Branch Exchange (PBX): A private telecommunications switching system.

Z. Provide: Furnish, install, and connect ready for fully functional use by the owner.

AA. Pull Point (PP): A space used to transition between floors for backbone and horizontal cabling within a building riser system.

BB. Telecommunications: A branch of technology concerned with the transmission, emission, and reception of signs, signals, writing, images, and sounds; that is, information, of any nature by cable, radio, optical, or other electromagnetic systems.

CC. Telecommunications Room (TR): A special purpose room designed to serve a single floor. In buildings with multiple floors, telecommunications rooms shall be vertically stacked to form a backbone pathway. The telecommunications room is the point in the voice and data infrastructure that the backbone and horizontal distribution systems are connected to each other. This room can contain equipment to support all of the following: cable infrastructure, data and voice communications, wireless (satellite), paging, fire /smoke detection, security alarm systems, radio, area of rescue assistance equipment, CATV and video conferencing.

DD. Universal Cabling System (UCS): A system that attempts to wire a building for information needs without knowing specifically what equipment will be utilized. A UCS is geared for long-term stability and flexibility and is based on the idea of wiring a building once.

EE. Wireless Access Point (WAP): Wireless access points are specially configured nodes on wireless local area networks (WLANs). Access points act as a central transmitter and receiver of wireless local area network radio signals.

FF. Power Over Ethernet (POE): Power-over-Ethernet or "Active Ethernet" eliminates the need to run 110/220 VAC power to Wireless Access Points (WAP's) and other devices on a wired LAN. Using Power-over-Ethernet system installers need to run only a single CAT5 Ethernet cable that carries both power and data to each device. This allows greater flexibility in the locating of access points and network devices and significantly decreasing installation costs in many cases.

GG. Voice Over Internet Protocol (VOIP): Voice over Internet Protocol is the transmission of voice traffic over IP-based networks.

1.5 REFERENCE STANDARDS

A. CEA-310 - Cabinets, Racks, Panels, and Associated Equipment; Consumer Electronics Association; Revision E, 2005.

B. ICEA S-90-661 - Category 6 & 6A Individually Unshielded Twisted Pair Indoor Cable for Use in General Purpose and LAN Communications Wiring Systems; Insulated Cable Engineers Association; 2002. (CAT 6E is required for this project)

C. NFPA 70 - National Electrical Code: 2008. In addition to standards related to electrical safety, the NEC has several sections that specifically address low voltage cable installation.

D. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual, 10th Edition. This is a manual of proven design guidelines and methods accepted by the telecommunications industry.

E. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; Rev A, 1988(R 2002).

F. TIA-492AAAB-A - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009.

G. TIA-526-7 - OFSTP-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant; 2002.

H. TIA-526-14 - OFSTP-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; Rev A, 1998(R2003).

I. TIA/EIA-568-B.1 - Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements; Rev B, 2001; Addenda 1-7.

J. TIA/EIA-568-B.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Rev B, 2001; Addenda 1-11.

K. TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables; Rev B, 2000; Addendum 1.

L. TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; 2009.

M. TIA-570 - Residential Telecommunications Infrastructure Standard; 2009.

N. TIA/EIA-606 - Administration Standard for the Telecommunications Infrastructure; Rev A, 2002.

O. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.

P. ANSI/TIA/EIA 758, BICSI Customer Owned Outside Plant Telecommunications Cabling Standard. This standard provides specifications for inter-building communication facilities that include cable media, pathways and spaces.

Q. ANSI/TIA/EIA 862, Building Automation Systems Cabling Standard for Commercial Buildings. This standard describes the generic cable system for building automation systems (BAS) that are intended to support a multi-product, multi-vendor automation environment within public and commercial buildings.

R. UL 444 - Communications Cables; Current Edition, Including All Revisions.

S. UL 1863 - Standard for Communications-Circuit Accessories; Current Edition, Including All Revisions.

T. ANSI/TIA/EIA 607 - Commercial Building Grounding and Bonding Standard.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Field Test Reports.

1.7 COORDINATION

A. Coordinate layout and installation of voice and data communication cabling with Owner's telecommunications and LAN equipment suppliers. Coordinate service entrance arrangement with Owner.

1. Coordinate in joint meetings with telecommunications and LAN equipment suppliers, Owner information and agree on details of equipment arrangements and installation interfaces. Record agreements reached in and distribute to other participants.
2. Adjust arrangements and locations of distribution frames, cross-connect panels and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Match existing equipment and devices.

B. All materials shall conform to the current applicable industry standards including, but not limited to the following standards relative to telecommunications and electrical equipment, devices, and gear:
1. NEMA (National Electrical Manufacturers' Association)
2. ANSI (American National Standards Institute)
3. ASTM (American Society for Testing and Materials)
4. ICEA (Insulated Cable Engineers Association)
5. IEEE (Institute of Electrical and Electronic Engineers)
6. National Electrical Safety Code (NESC
7. National Electrical Code (NEC), 2008 (NFPA 70)
8. Telecommunications Industry Association (TIA)
9. Electronic Industries Alliance (EIA)
10. Underwriters Laboratories (UL)

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cabling and Equipment:
1. Berk-Tek: www.berktek.com
2. TE Connectivity: www.te.com.
3. Belden Inc.: www.belden.com.
4. Comscope (Systimax Solutions): www.comscope.com.
5. Leviton: www.leviton.com.
6. Hubbell: www.hubbell.com.
7. General: www.generalcable.com.
8. Chatsworth Products, Inc.: www.chatsworth.com.
9. Mohawk: www.mohawk-cable.com.
10. Superior Essex: www.superioressex.com.
11. Optical Cable Corporation: www.occfiber.com.
12. Middle Atlantic Products, Inc.: www.middleatlantic.com.
13. Siemon Company: www.siemon.com.
14. Corning Cable Systems: www.corningcablesystems.com.

B. Outlet Boxes, Floor Boxes and Surface Raceways:
1. Hubbell Wiring Devices: www.hubbell-wiring.com
2. Wiremold: www.wiremold.com.
3. Cooper Wiring Devices: www.cooperwiringdevices.com.
4. Leviton Manufacturing, Inc: www.leviton.com.
5. Pass & Seymour: www.passandseymour.com.
6. Bryant Electric: www.bryant-electric.com.
7. GE Industrial: www.geindustrial.com.
8. Refer to schedules in Section 16140 "Wiring Devices," Part 4 Appendix for listings of approved manufacturers with catalog numbers. Notify Engineer of any changes, deficiencies or discrepancies in catalog numbers shown in these tables.

2.2 SYSTEM DESIGN

A. Provide a complete, fully functioning, and permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with TIA/EIA-568 and TIA/EIA-569, latest editions.
   2. Provide fixed cables and pathways that comply with NFPA 70 and ANSI/J-STD-607 and are UL listed or third-party independent testing laboratory certified.
   3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, non-condensing.
   4. Provide cable management systems cable tray, wiring baskets or J-hooks to support all cables run in corridors or other areas where such systems are installed. Where used, J-hooks shall be spaced no further than 60" apart.

B. Capacity:
   1. Backbones: 100 pairs, copper.
   2. Horizontal Cabling: Copper.

C. Main Distribution Frame (MDF): Centrally located support structure for terminating backbone cables, functioning as point of presence to external service provider.
   1. Locate main distribution frame as indicated on the drawings.
   2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.
   3. Arrange patch panels, switches and other equipment in frames as shown on drawings.

D. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
   1. Locate intermediate distribution frames as indicated on the drawings.
   2. Identify patch panels located in intermediate distribution frames.
   3. Arrange patch panels, switches and other equipment in frames as shown on drawings.

E. Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame (MDF) at center hub of star.

F. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".
   1. The standard installation is universal cabling, 3 Category 6E cables and jacks and the raceway size to the box is 1", as a minimum. (CAT 6E is required for this project)
   2. The typical telecommunications outlet can be provisioned to accept six (6) telecommunications ports that can provide Category 6E voice and data connections. For outlet boxes with more than 3 cables or where Category 6E cables are installed, increase size of raceway to outlet box by one (1) additional trade size, as minimum. (CAT 6E is required for this project)

2.3 PATHWAYS

A. Conduit: As specified in Section 26 0534; provide pull cords in all raceways and conduits.

B. Cable Trays: As specified in Section 26 0536.

C. Provide for 40% growth in all pathways unless otherwise specified and approved by Owner.

D. Provide conduits and boxes for other systems such as code blue emergency phones, elevator phones, mechanical metering equipment, electrical metering equipment, wall phones, and pay phones.

E. Provide raceway systems, conduits, sleeves, and boxes for penetrations through all wall and floors for cable routes.

F. Provide an inter-building cabling infrastructure with pathways. The system shall originate from the main equipment room in the building and distribute to telecommunications rooms.

G. Provide raceways and cable tray systems in hallways and other accessible areas, above ceilings where applicable or as specified in the project documents and drawings. Provide transitions for cable trays to conduit systems in all inaccessible areas.

H. Install cable tray and raceway systems according to the manufacturers' product installation instructions using the manufacturers' approved methods and components.

I. Bond and ground all conduits, cable trays, racks, and other infrastructure to the main building ground, as required by latest versions of NEC and TIA 607A codes and standards.
   1. Install in accordance with Article 250 of NEC. Clean all surfaces and remove non-conductive coatings, such as paint, lacquer, and enamel that may be deposited on equipment.
   2. Remove all non- conductive coatings, such as paint, lacquer, and enamel from threads and other contact surfaces to ensure good electrical continuity.

J. Provide and document all re-enterable UL listed fire stop assemblies at all penetrations through fire-rated walls, floors, and other barriers.

2.4 COPPER CABLE AND TERMINATIONS

A. Copper Backbone Cable: TIA/EIA-568 Category 6E minimum solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm or Category 6 solid conductor unshielded twisted pair (UTP), 23 AWG, as indicated; 100 pairs formed into 25-pair binder groups; covered with gray thermoplastic jacket and complying with all relevant parts of and addenda to latest editions of TIA/EIA-568 and ICEA S-90-661, and UL 444. (CAT 6E is required for this project)
   1. In locations other than in plenums, provide NFPA 70 type CMR riser-rated or type CMP plenum-rated cable.
   2. In plenums, provide NFPA 70 type CMP plenum-rated cable.
   3. Provide cable having conductors twisted at minimum rate of 36 per foot (108 per meter); actual length and frequency of twists at manufacturer's option.
   4. Color code conductors in accordance with ICEA S-90-661.
   5. Testing: Furnish factory reel tests.

B. Copper Horizontal Cable: TIA/EIA-568 Category 5E solid conductor unshielded twisted pair (UTP), solid annealed 23 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444. (CAT 6E is required for this project)
   1. In locations other than in plenums, provide NFPA 70 type CMG general purpose, CMR riser-rated, or type CMP plenum-rated cable.
   2. In plenums, provide NFPA 70 type CMP plenum-rated cable.

C. Copper Horizontal Cable: TIA/EIA-568 Category 5e solid conductor unshielded twisted pair (UTP), solid annealed 24 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444. (CAT 6E is required for this project)
   1. In locations other than in plenums, provide NFPA 70 type CMG general purpose, CMR riser-rated, or type CMP plenum-rated cable.
   2. In plenums, provide NFPA 70 type CMP plenum-rated cable.

D. Copper Riser Cable: TIA/EIA-568 Category 5e solid conductor unshielded twisted pair (UTP), solid annealed 24 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444. Cable shall be rated as riser-type cabling. (CAT 6E is required for this project)
   1. Provide NFPA 70 type CMP plenum-rated cable.
   2. Quantity: As indicated on drawings.

E. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

F. Jacks and Connectors: RJ-45, non-keyed, terminated with 110-style insulation displacement connectors; high impact thermoplastic housing; complying with same standard as specified horizontal cable and UL 1863.
   1. Performance: 500 mating cycles.
   2. Voice and Data Jacks: 4-pair, pre-wired to T568B configuration, with color-coded indications for T568A configuration. Jack shall be removable (modular) from a frame or faceplate.
   3. Jacks shall be 8-pin modular, IDC type, in compliance with appropriate wiring specifications, as defined above, and shall be removable (modular) from a frame or faceplate.
   4. Match category rating of jack to category rating cable terminated, unless indicated otherwise.
   5. The outlet can be provisioned to also accept three Category 6-Augmented cables, if the conduit trade size is increased by at least one (1) trade size. Telecommunications outlets can also support variations of transmission media including CATV and optical fiber applications to the workstation or desktop. To accommodate multiple applications each outlet must be individually designed for the application.

G. Patch Panels and Cords: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
   1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus 25% spares and blank positions adequate to satisfy specified expansion criteria.
   2. Mounting: 19" wide equipment rack.
   3. Patch Cords: Shall be type UTP with four-pair cables in 48-inch (1200-mm) and 36-inch (900-mm) lengths, terminated with RJ-45 plug at each end. Use non-keyed plugs for data service.

2.5 FIBER OPTIC CABLE AND ADAPTORS

A. Fiber Optic Backbone Cable: 24-fiber, multimode 50/125 um, complying with TIA-492AAAB; covered with orange cable jacket and complying with relevant portions of and addenda to latest edition of TIA/EIA-568. Fiber optics cabling shall be 12-strand, single mode with an interlocked armour with a plenum rating and a yellow colored jacketing.
   1. Optical Characteristics: 50 micrometer/125 micrometer laser optimized fibers for high-end 10 GHz applications for new installations. Some existing applications may require 62.5 micrometers/125 micrometer multimode optical fibers.
      a) Attenuation: 3.5 dB/km @ 850 nm; dB/km @ 1300 nm.
      b) Bandwidth: 160 MHz/km @ 850 nm; 500 MHz/km @ 1300 nm.
   2. In locations other than in plenums, provide NFPA 70 type OFNR nonconductive-riser-rated or type OFNP nonconductive-plenum-rated cable.
   3. In plenums, provide NFPA 70 type OFNP nonconductive-plenum-rated cable.
   4. Testing: Furnish factory reel tests.

B. Fiber Optic Backbone Cable: single mode complying with TIA-492AAAB and the following additional requirements:
   1. Optical Characteristics: Single-mode fiber optic cable 8.3 micrometer/125 micrometer single mode low water peak optical fibers.
   2. Attenuation: 0.35 dB/km @ 1310 nm; 0.25 dB/km @ 1550 nm.

C. Fiber Optic Horizontal Cable: Two-fiber, multimode 50/125 um, complying with TIA-492AAAB; covered with orange single jacket and complying with relevant portions of and addenda to latest edition of TIA/EIA-568.
   1. In locations other than in plenums, provide NFPA 70 type OFN nonconductive general purpose, OFNR nonconductive-riser-rated, or type OFNP nonconductive-plenum-rated cable.
   2. In plenums, provide NFPA 70 type OFNP nonconductive-plenum-rated cable.

D. Fiber Optic Cable Mechanical Specifications
   1. Maximum tensile loading: Installation: 2700 N (600lb/ft); Long term installed: 890 N (200lb/ft)
   2. Operating Temperature: Storage: -40° to +70° C (-40° to +158° F) Long Term: -40° to +70° C (-40° to +158° F).
   3. Minimum bend radius (12 and 48 strand armored fiber optic cable): Loaded: 8.9 inches; Installed: 6.0 inches Minimum bend radius (12 and 48 strand all-dielectric fiber optic cable): Loaded: 7.0 inches; Installed: 4.6 inches.
   4. Mechanical Construction: Armored fiber optic cable for direct-burial and raceway or conduit installation. Construction shall include: locatable central strength member, water swell-able yarn, buffer tubes/fibers, water swell-able tape, ripcord, polyethylene inner jacket, high tensile strength, corrugated steel tape armor (for direct burial applications), polyethylene outer jacket, UV-stabilized jacket or equivalent. Fiber optics cabling shall be 12-strand, single mode with an interlocked armour with a plenum rating and a yellow colored jacketing.
   5. Color Codes for Optical Fiber Cables: Buffer tubes and individual strands shall be color coded as shown in the table below.

NUMBER	COLOR
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Rose
12	Aqua

6. Cable shall be assembled to ensure that no more than 12 fiber strands occupy each buffer tube.

E. Fiber Optic Adapters: Type LC, multimode adaptors with Zirconia ferrule ceramic alignment sleeves; complying with relevant parts and addenda to latest edition of TIA/EIA-568 and with maximum attenuation of 0.3 dB at 1300 nm with less than 0.2 dB change after 500 mating cycles when tested in accordance with TIA-455-21. Adapters shall be colored blue.
   1. Provide for all new fiber optic installations with Type LC terminated connectors. When adding to or modifying existing work coordinate connector type with Owner. LC connector pigtails shall have no direct connections.
   2. Fiber Optic Loose Tube Cable Furcation Kit provide: Corning Buffer Tube Fan-Out Kit - 12 fiber, indoor and outdoor cable. Corning part number FAN-BT25-12 for installation into CCH connector modules and WIC enclosures. 4C-FDU shall be Corning part number CPH-1-U.

F. Fiber Optic Connectors: Type LC, multimode adaptors with alignment sleeves; maximum attenuation of 0.3 dB at 1300 nm with less than 0.2 dB change after 500 mating cycles when tested in accordance with TIA-455-21.
   1. Provide for all new fiber optic installations with Type LC terminated connectors. When adding to or modifying existing work coordinate connector type with Owner.
   2. Single-mode connectors provide: Corning Part Number 95-200-42 Ultra-polished Unicam LC connectors.
   3. Multimode connector provide: 3M Part Number 6300 Hot Melt LC connector or Corning Part Number 95-000-41 Unicam LC connector.
   4. Fiber Optic Termination Enclosures and Associated Hardware:
      a) Wall mounted enclosures at each end point (i.e., BDF and IDF) shall be: Two (2) side-by-side Corning Cable Systems #WIC-012 per 12-strand multimode or single-mode fiber optic cable. Enclosures for multimode fiber shall be complete with multimode connector panels with LC adapters, Corning Cable Systems # WIC-CP1-039.
      b) Enclosures for single-mode fiber to be complete with single-mode connector panels with LC adapters, Corning Cable Systems # WIC-CP1-038.
      c) Rack mounted enclosures at the BDF shall be: One (1) Corning Cable Systems # CCH-02U housing at the top of the equipment frame for OSP fiber Optic termination.
      d) One (1) Corning Cable Systems # CJP-02U fiber wire management shall be installed directly below the CCH-02U panel.
      e) Owner shall provide location for mounting enclosures if not shown on drawings.

G. Fiber Optic Splice Enclosures:
   1. Fiber optic fusion splices shall be performed in underground facilities, therefore splice enclosures designed for use in an outside plant environment shall be used. Installer shall test splice to confirm integrity of spice.
   2. Splice closures are to be configured for through splices only when distribution from splice is not required.
   3. Where distribution is required from a splice closure, utilize splice closures with entrance from one end only.
   4. Provide the 9.5" x 28.0" Coyote # 800010884 splice enclosure or from both ends when installing the 8.5" x 22.0" Coyote # 80805514 splice enclosure with (2) 6 port end plates.
   5. No encapsulate shall be injected into closures after splices are completed.
   6. Provide Preformed Coyote Fiber Optic Splice Closures Kits, sized as required for the maximum fiber count within the splice case including distribution fibers.
   7. Pre-formed Splice Trays shall be used with Preformed Fiber Optic Splice Closures. Splice only 24 fibers per splice tray. There shall be no exceptions, without written approval from the Owner prior to installation.
   8. Pre-formed splice trays are to be labeled with a permanent black marker, such as a Sharpie, on the front face of each splice tray indicating fiber count.
   9. Support bracket kits for a Coyote Splice Case, sized as required for fiber count. Preformed part # 8003279 will support the splice case in maintenance holes, handholes and vaults.

H. Duct and Innerduct:
   1. Innerduct shall be installed in specified ducts as indicated herein. Innerduct shall be molded in orange polyethylene and be of solid wall configuration. Innerduct may be plenum to comply with requirements.
   2. Each innerduct installed shall have a one-quarter inch polyethylene pull rope placed within the innerduct secured at each end.
   3. Couplers:
      a) Provide aluminum threaded innerduct couplers to be used to join two segments of corrugated innerduct together. Non-metallic couplers are not acceptable.
      b) Provide Pyramid Innerduct Adapter 1-1/4 inches - Pyramid Part Number F09008 or equivalent. Carlon Threaded Aluminum Couplings 1-1/4 inches - Carlon Part # BS1.660 or equivalent.

4. Duct Plugs:
   a) Split Triplex Duct Sealing Plugs to be installed in 4-inch ducts containing Contractor-installed 1-1/4 inch innerducts.
   b) Jackmoon Triplex duct plugs - Jackmoon Part Number 40B167S or equivalent.
   c) Carlon Triplex duct plugs - Carlon Part Number MATPG3 or equivalent.
   d) Innerduct sealing plugs shall be used to seal used and unused innerducts. Use in conjunction with triplex duct sealing plugs.
   e) Provide Jackmoon blank duct plug 1-1/4 inches - Jackmoon part number 12D148U or equivalent.
   f) Provide Jackmoon fiber optic simplex duct plug 1-1/4 inches - Jackmoon part number 12S0XXSB or equivalent. Exact part number should be specified by Contractor upon materials order placement once exact cable diameters are known.

I. Fiber Optic Cable Labels:
   1. Stainless steel or plastic cable labels will be attached to all fiber optic cables using stainless steel straps or approved zip ties.
   2. Provide Panduit MMP stainless steel marker plates - 0.75 inch x 3.50 inches manufactured in 316 stainless steel. Panduit part number MMP350-C316.
   3. Provide Panduit Pan-Steel stainless steel clamps - MLT1S-CP Cable Support - J-Type pipe hangers; B-Line Products pipe hanger, B-Line Products part number 3690-X, or equivalent, sized appropriately.

2.6 CROSS-CONNECTION EQUIPMENT

A. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare. (CAT 6E is required for this project)

B. Patch Panels for Copper Cabling: Sized to fit EIA standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
   1. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
   2. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
   3. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
   4. Provide incoming cable strain relief and routing guides on back of panel.
   5. Patch Cords: Provide one patch cord for each pair of patch panel ports.

C. Patch Panels for Fiber Optic Cabling: Sized to fit EIA standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum.
   1. Adaptors: As specified above under FIBER OPTIC CABLING; maximum of 24 duplex adaptors per standard panel width.
   2. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
   3. Provide incoming cable strain relief and routing guides on back of panel.
   4. Provide rear cable management tray at least 8 inches (203 mm) deep with removable cover.
   5. Provide dust covers for unused adaptors.
   6. Patch Cords: Provide one patch cord for each pair of patch panel ports.

2.7 ENCLOSURES

A. Backboards: All backboards shall be interior grade plywood without voids, 3/4-inch (19 mm) thick; UL-labeled fire-retardant and treated on all sides with a minimum of two (2) coats of fire-resistant paint.
   1. Size: 48 inches (1220 mm) wide by 96 inches (2440 mm) high.
   2. Do not paint over or cover fire retardant UL label or stamp so that it remains visible.
   3. The bottom of the plywood shall be mounted at 18" above the finished floor (AFF).

B. Equipment Racks and Cabinets: CEA-310 standard 19 inch (482.6 mm) wide component racks.
   1. Floor Mounted Racks: 16 gage steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.
      a) Floor mounted equipment rack shall be 4-post type rack.
      b) Cable management channels shall be provided on one side of the rack and on front and back of the rack.
      c) Equipment rack shall be Chatsworth Universal Rack™ part number 46353-X03 19" x 7'-0" high and painted black, unless otherwise specified.
      d) Equipment racks shall also include Chatsworth QuadraRack™ part number 50120-X03. 4-Post Frame for data equipment and painted black, unless otherwise specified.

e) Racks are to be joined vertically using the Chatsworth Global Vertical cabling solution part number 12831-703.
f) Junction plate at top of equipment frame shall be Homaco # JP0912.
g) The specifications for frames and ancillary equipment are subject to change depending on Owner's build-out design guidelines.

2. Freestanding Cabinets: Front and rear doors with locks; removable side panels with locks; vented top and rear door; adjustable leveling feet; cable access in roof and base; grounding bar.
   a) Roof mounted fan, capacity to support systems, as specified.
   b) Duplex AC power outlet inside cabinet.
3. Wall Mounted Cabinets: Front doors with locks, louvered side panels, top and bottom cable access, and ground lug.
   a) Cover inside of cabinet back with plywood backboard as specified.
   b) Roof mounted fan, capacity to support systems, as specified.
   c) Duplex AC power outlet inside cabinet.
4. Cabinets: 16 gage steel construction with corrosion resistant finish.
5. Locks: Keyed alike.

C. Building Entrance Protector: Factory fabricated panel to connect incoming cable and interior cable to protector modules.
1. Capacity: One protector module per pair in incoming cable.
2. Protector Modules: Type 4B1S-300, or equivalent, and rated for the application.
3. Incoming Side: Provide connector blocks of type specified.
4. Outgoing Side (to Interior): Backbone cable wired to connector blocks.

D. Outlet Boxes: For flush mounting in walls; depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
1. Size, Unless Otherwise Indicated: 4-11/16 inches (119 mm) square by 2-1/8 inches (54 mm) deep with one (1) 1-1/4"conduit knock-out, as minimum.
2. Wall-Mounted Telephones: 4 inches (100 mm) high by 2 inches (50 mm) wide by 2-1/8 inches (54 mm) deep.
3. Boxes for Fiber Optic Outlets: Single or two gang as indicated.
   a) Size: 4-11/16 inches (119 mm) square by 2-1/8 inches (54 mm) deep.
4. Outlet Box Mud-Ring: Provide mud-ring for each outlet box to extend total depth of each box to 3-1/8 inches deep. In addition, telecommunications boxes shall also meet the following requirements:
   a) The depth of the box shall accommodate a 1-1/4" cable bend radius, which meets or exceeds the specifications for fiber optic and UTP cabling and TIA/EIA-569A requirements for communications pathways.
   b) Boxes shall accommodate a complete line of connectivity outlets and modular inserts for UTP (Category 5, 5e, and 6-Augumented cables) STP (150 ohm) fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. (CAT 6E is required for this project)
5. Raceway Size from Outlet Box: Provide 1" trade size (metric designator 27) raceway, as a minimum, from each outlet box to the nearest space above an accessible finished ceiling or nearest cable tray or conduit system. Raceway shall be continuous from outlet box to termination at either of these locations. Terminate raceways at 6" above nearest side rail of cable tray. Provide a bushing on each end of raceways.
6. Outlet Boxes for Other Systems, Equipment or Phones: Provide raceways sized as shown above for outlet boxes for other systems and install any necessary support pads for power and communications cabling. Conduit shall extend from the outlet box to the nearest cable tray or conduit system and terminate 6" above cable tray at nearest side rail.
7. For outlet boxes with more than 3 cables or where Category 6 cables are installed, provide 1.25" conduit instead of 1" conduit and install as above.
8. Empty Raceways: Provide a measured pull string secured at the termination point of each empty raceway.
9. Faceplates: High impact thermoplastic, complying with system design standards and UL 514C.
10. Labels: Comply with TIA/EIA-606 using encoded identifiers; label each jack on the face plate as to its function with a unique numerical identifier. Comply with labeling requirements in this and Section 16075 "Electrical Identification."
11. Outlet box shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 5, 5e, 6 Augmented) STP (150 ohm) fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. Where indicated, provide connectivity outlets and modular inserts by Ortronics. (CAT 6E is required for this project)

E. Floor Boxes: Floor boxes and covers shall be watertight and heavy duty in construction and easily accessible, provide flush or recessed device outlets that will not obstruct the floor area, and be furnished with protective covers for power and data ports.

1. Raceways: Provide a minimum 1.5" trade size (metric designator 41) raceway to each floor box installed.
2. Floor Box Flanges: Floor box options shall accept both brass and nonmetallic cover plates and flanges. Flanges for both brass and nonmetallic shall be 1, 2 or 3 gang applications installed in boxes. Each flange shall provide a minimum of ½" adjustment to accommodate various floor coverings and concrete depths.

2.8 IDENTIFICATION PRODUCTS

A. Comply with Division 16 Section "Electrical Identification" and any additional requirements in this section.

B. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

C. Faceplate Labels: Self-adhesive vinyl or vinyl-cloth tape markers, machine printed with alphanumeric device designations.

2.9 HORIZONTAL CABLE TYPES

A. One (1) Gigabit Ethernet (Including Trunked Connections) Rated for 1000/100/10 Mbps: Category 5e, 24 AWG, solid conductor unshielded twisted pair (UTP). Cable jacket color shall be blue. (CAT 6E is required for this project)

B. Ten (10) Gigabit Ethernet: Category 6 A, 10 G, 23 AWG, foiled, solid conductor unshielded twisted pair (F/UTP). Cable jacket color shall be blue.

C. Power Over Ethernet (POE): Category 6, 23 AWG, solid conductor unshielded twisted pair (UTP). Cable jacket color shall be blue.

D. Wireless Applications: Category 6, 23 AWG, solid conductor unshielded twisted pair (UTP). Cable jacket color shall be blue.

E. Analog and Digital Telephone Service: Category 5e, 24 AWG, solid conductor unshielded twisted pair (UTP). Cable jacket color shall be blue. (CAT 6E is required for this project)

F. Telemetry and Patient Monitoring (IP and RS-232): Category 5e, 24 AWG, solid conductor unshielded twisted pair (UTP). Cable jacket color shall be blue. (CAT 6E is required for this project)

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA/EIA-568, TIA/EIA-569, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with latest editions and addenda of TIA-570, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

3.2 PATHWAYS

A. Underground Service Entrance: Install conduit at least 18 inches (450 mm) below finish grade; encase in at least 3 inches (75 mm) thick concrete for at least 60 inches (1500 mm) out from the building line.

B. Install with the following minimum clearances:
1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches (300 mm) from power conduits and cables and panelboards.
3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.
4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.

C. Conduit:
1. Do not install more than 2 (two) 90-degree bends in a single horizontal cable run.
2. Leave pull cords in place where cables are not initially installed.

3. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
   a) Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
   b) Treat conduit in crawl spaces and under floor slabs as if exposed to view.
   c) Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.
   d) Under floor slabs, locate conduit at 12 inches (300 mm), minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.

D. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

E. Firestopping: Seal openings around pathway penetrations through fire-rated walls, partitions, floors, and ceilings in accordance with Section 07 8400.

F. This Contractor shall be responsible for furnishing all materials on the drawings or as specified herein for a complete telecommunications system. This contractor shall also be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate the work with other trades.

G. All telecommunications infrastructure shall be installed in an aesthetically pleasing fashion and method, as well as optimal performance of the system. Telecommunications infrastructure shall also be installed to facilitate modifications, additions, and other future changes.

H. All work performed in occupied spaces shall be in a manner that allows the Owner to operate the existing facilities without interruption. User outages, including wireless access points, shall be submitted to the Owner for approval two weeks before beginning work.

I. All new telecommunications rooms must be free from dust, dirt, and other foreign materials before installation of any termination hardware or termination of any copper or fiber optic cables.

J. Provide a manufacturer's warranty of not less than 20 years on structured cabling systems.

K. All work by the contractor must comply with the manufacturer's product recommended installation instructions and warranty requirements, as well as the standards listed in the in this specification.

L. The contractor is required to obtain all permits from the proper jurisdiction for all work associated with this specification.

M. The contractor shall provide the Owner with all station documentation and test results upon the substantial completion of the project.

3.3 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 120 inches (3000 mm).
   2. At Outlets - Copper: 12 inches (305 mm).
   3. At Outlets - Optical Fiber: 39 inches (1000 mm).

C. Copper Cabling:
   1. Category 5e/6: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination. (CAT 6E is required for this project)
   2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
   3. Copper Cabling Not in Conduit: Use only type CMP plenum-rated cable as specified.

D. Fiber Optic Cabling:
   1. Prepare for pulling by cutting outer jacket for 10 inches (250 mm) from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
   2. Support vertical cable at intervals as recommended by manufacturer.

E. Wall-Mounted Racks and Enclosures:
   1. Install to plywood backboards only, unless otherwise indicated.
   2. Mount so height of topmost panel does not exceed 78 inches (1980 mm) above floor.

F. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.
   1. Arrange equipment in racks as shown on drawings.
   2. Provide power outlets mounted at the top of each rack, as shown on drawings

G. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.
   1. Cables: Install color coded labels on both ends.
   2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.
   3. Patch Panels: Label each jack as to its type and function, with a unique numerical identifier.
   4. Patch Cords: Label with jack identifier corresponding to initial installation.

H. Ground and bond all equipment racks and wall fields. Provide grounding connections for cable and other system components as required by manufacturer's written instructions.
   1. Comply with Division 16 Section "Grounding and Bonding."
   2. Provide a solid copper grounding busbar with insulated standoffs in each telecommunications room, equipment room or telecom closet. Busbar shall be 1/4" thick x 4" wide and a minimum of 12" long. Each busbar shall be drilled with rows of holes according to NEMA standards, for attachment of bolted compression fittings and shall match EIA/TIA requirements. Busbar shall be sized adequately for all grounding conductors in that closet to be connected with minimum of 10% additional space for future additions or expansions.
   3. Solid copper grounding busbar shall be Chatsworth part number 40153-012 or equivalent, as accepted and approved by owner.
   4. All telecommunications equipment, frames, cabinets, and other equipment shall be grounded to the grounding busbar in each room using a minimum #6 AWG conductor. All grounding and bonding conductors shall be bare copper or a conductor color coded green.
   5. Busbars in each telecommunications room, equipment room or telecom closet shall be connected by a backbone of insulated, solid copper cable between all closets and rooms using a minimum #3/0 AWG conductor. All grounding and bonding conductors shall be bare copper or a conductor with appropriate identification per NEC requirements.
   6. Terminate all ground conductors to ground terminals or ground buses in equipment rooms and wiring closets.

I. Wiring Methods: Install wiring and optical fiber in raceway or other cable management systems, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces. Minimum raceway size shall be 1" conduit.
   1. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings.
   2. Where raceways are not provided, install cabling in accessible ceilings, minimum 18" above suspended ceiling. Support cable a minimum of every 30" from the building structure. Do not support cable from suspended ceilings. Install cables above accessible ceilings in common areas and corridors to the furthest possible point for convenient access.
   3. Install cables without damaging conductors, shield, or jacket and using techniques, practices, and methods that are consistent with Category rating of the cable installed and that ensure the performance of the completed and linked signal paths, end to end, of the category rating indicated.
   4. Use cable management systems such as cable tray, wiring baskets or J-hooks to support all cables run in corridors or other areas where such systems are installed. Where used, J-hooks shall be spaced no further than 60" apart.
   5. Do not install structured cabling within 12" of power and lighting wiring, or within 12" of a fluorescent lighting and electrical fixtures.
   6. Install all riser cables through sleeves with minimum 2" diameter. Support riser cable through sleeves at a minimum of even floor number intervals. Select support system based on site conditions and weight of cable.
   7. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
   8. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Pull cables simultaneously if more than one cable is being installed in same raceway. If pulling compound or lubricant is used, ensure these will not damage conductors or insulation.

J. Wiring within Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess lengths. Use wire distribution spools at points where cables are fanned or conductors turned. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer. Connect conductors that are terminated, spliced, or interrupted to terminal blocks. Label each terminal with designations approved by the Owner. Install wiring on racks and at wall mounted connection blocks through wire management devices.
   1. Do not install structured cabling within 12" of power and lighting wiring, or within 12" of a fluorescent lighting and electrical fixtures.
   2. Install exposed cables parallel and perpendicular to surfaces, enclosures, or exposed structural members and follow enclosure and surface contours where possible.
   3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

3.4 IDENTIFICATION AND LABELING

A. Comply with requirements in Section 16075 "Electrical Identification" and the additional requirements in this section.

B. Horizontal Copper Cable Labeling:
   1. All horizontal cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, or equivalent labeling system.
   2. Identification shall be as follows:
      a) At the telecommunications room (TR) end, the cables shall be labeled with the location of where the other end of the cable is terminated including room number, telecommunications outlet (TO) number, and jack position. Place label on a visible part of cable within 12" of termination point for ease of identification after termination.
      b) At the TO end, the cables shall be labeled 4" from termination with the following: TR - Rack.Patch Panel.Port. This shall be visible by removing outlet cover plate.
      c) For voice cabling in older building with separate voice closets and no patch panels, include the TR and as much information as practical such as column, row, block number, and port number or pairs.
   3. For CATV coaxial drop cables, at the splitter or tap, the cables shall be labeled with the location where the other end of the cable is terminated including room number, TO number, and jack position. If not co-located with a TO, indicate room number at a minimum. Place label on a visible part of cable within 12" of termination point for ease of identification after termination.

C. Telecommunications Outlet (TO) Labeling Scheme:
   1. (TO's) are labeled alphanumerically in a clockwise rotation around the room. Typically, the first TO located to the left of the main entrance of the room is labeled 1A, followed by 2A, 3A, etc. Where two entrances are present, designate one as the main entrance and label accordingly. The intent is to have unique identification for each TO. The starting point and nomenclature of the TO's are irrelevant to the location inside the room.
   2. Floor box TO's shall be prefaced with "FB" to read FB1A, FB2A, etc.
   3. Wireless Access Point TO's in ceilings shall be prefaced with "W" to read W1A, W2A, etc.
   4. On subsequent TO installations, the TO shall be labeled alphanumerically depending on where the new TO is. If the new TO is between 1A and 2A, the new TO would be labeled as 1B. If another one is later added between 1B and 2A, it would be labeled 1C. If it is after the last TO in the room, 3A, it would be labeled 4A.
   5. Seek clarification from Owner's telecommunications personnel for any labeling issues that arise.

D. Faceplate Labels:
   1. Faceplates will be labeled using the plastic insert to cover a printed identification tag. Each of the 2 labels in a faceplate is meant to have 2 lines for a total of 4 individual lines per faceplate.
   2. The TO label will vary slightly depending on whether a unified cabling platform is used where all cables go to one TR, or separate voice and data closets are used.
   3. Coordinate with Owner's Telecommunications representative for examples of labeling schemes and sample procedures.

E. Horizontal 110 and 66 Block Labeling for Voice:
   1. For 110 blocks, if the cables are for room terminations, label the appropriate corresponding space for the port with the room number, TO, and jack position.
   2. For 66 type blocks, if the cables are for room terminations, tag the cable with the room number, TO, and jack position with a loose paper tag that is easily accessible and readable.
   3. If the 110 block is for the tie cable between the voice patch panel in the rack and the wallboard, label the space corresponding to the port with the rack, patch panel and port information as per Patch Panel labeling section below. For tie cables between the rack and wallboard a 110 block should always be used.

F. Patch Panel Labeling:
   1. For station cabling going to a TO, label each port on the patch panel with the room number, TO, and jack position.
   2. For voice patch panels connected to a 110 block within the TR, label each port on the voice patch panel with the corresponding 110 block source information as given above.

G. Vertical Riser Copper Cable Labeling:
   1. All riser cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, or equivalent labeling system. Identification shall be as given in this section.
   2. At the TR, the copper riser cables shall be labeled with from/to, cable type (C for copper), cable number, and count information on both ends. Place label on a visible part of cable close to wiring block for ease of identification after termination.
   3. Label cabling every 50' along the length of the cable in open trays, and on each side of wall penetrations.
   4. All cables shall be labeled permanently with from/to information, cable type and size, installation date, and installing contractor at each end, manhole, and pull box the cable passes through.

H. Vertical Riser Fiber Cable Labeling:
   1. All riser cables shall be labeled with self-laminating marking tape, Brady ID-Pro labeler, Panduit LS7 labeler, or equivalent labeling system. Identification shall be as given in this section.
   2. At the TR, the fiber riser cables shall be labeled with from/to, cable type (F for Fiber), and cable number on both ends. Place label on a visible part of cable close to wiring block for ease of identification after termination.
   3. Label cabling every 50' along the length of the cable in open trays, and on each side of wall penetrations.
   4. All cables shall be labeled permanently with from/to information, cable type and size, installation date, and installing contractor at each end, manhole, and pull box the cable passes through.
   5. Labels for all fiber cables shall indicate type of fiber (single mode or multi-mode 50 or 62.5 micron), pair count, loss for each strand, and length of cable, in addition to the above information.

I. Vertical Riser 110-Block Labeling:
   1. At the Building Distribution Frame (BDF) and IDF, voice riser cables are terminated on their respective 110 blocks. Label only first and last pairs on each row of 110 blocks with the matching pair count information.
   2. Place the entire cable label in the center of the 110-block label as given in Intra-Building Vertical Riser Copper Cable Labeling section given above: B065 - 114 - C01, 1-50.

J. Coax Trunk Labeling for CATV:
   1. CATV coaxial trunk cables shall be labeled at each termination point with the information indicating the location of the next termination point of the cable, such as an amplifier, DCT, splitter, or tap.

K. Raceway Labels:
   1. All conduits and raceways intended to carry fiber or copper distribution cables shall be labeled as "Communications" every 25' of raceway length, as a minimum.
   2. Labels shall be permanent such as manufactured label stencils or other methods approved by the Owner.

3.5 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards and owner requirements.
   1. Contractor shall notify the responsible Owner's Telecommunications Manager before beginning any testing. Owner's personnel may accompany the contractor during testing for verification purposes.
   2. 100% testing of all cables is required.
   3. The horizontal cabling consisting of single 4-pair cable runs, including those designated for voice, shall be tested for the relevant CAT 5e or CAT 6a Permanent Link Test compliance.
   4. Contractor shall provide a copy of the test reports in hardcopy or soft copy format, depending on the size of the project and requirements of the Telecommunications Facility Manager. (CAT 6E is required for this project)
   5. Owner's personnel may perform random verification testing as part of acceptance of all copper cable testing.

B. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.
   4. Inspect patch cords for complete labels.

C. Testing - Horizontal Cable:
   1. Testing shall be performed in accordance with TIA/EIA 568-B or other applicable standards with equal or higher requirements.
   2. Both link and channel parameters shall pass manufacturer's requirements for performance of twisted pair cabling systems. Marginal or star pass measurements will not be acceptable.
   3. Optical fiber links shall be tested using a power meter measuring for link loss at a budget established from the link components (connector + optical fiber + connector), as specified by the manufacturer and TIA/EIA 568-B. One directional test is required for horizontal links that pass initial tests.
   4. Acceptable testing equipment for intra-building tests shall be: Fluke DTX-1800, or equal as approved by Owner.

D. Testing - Copper Cabling and Associated Equipment:
   1. Test backbone cables after termination but before cross-connection.
   2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
   3. Test operation of shorting bars in connection blocks.
   4. Category 3 Backbone: Perform attenuation test.
   5. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational and ring-back, and dial tone.
   6. Category 5e/6 Backbone: Perform testing to current standards to certify cabling integrity. (CAT 6E is required for this project)
   7. Category 5e/6 Links: Perform testing to current standards to certify cabling integrity. (CAT 6E is required for this project)

E. Testing - Fiber Optic Cabling:
   1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
   2. Multimode Backbone: Perform tests in accordance with TIA/EIA-526-14 Method B.
   3. Single Mode Backbone: Perform tests in accordance with TIA-526-7 Method B.
   4. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.

F. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone, as required.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SETION 27 11 16 COMMUNICATION CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor are held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation. The approved vendor or designated agent is held responsible to be familiar with the provisions contained herein and is assumed to possess the knowledge, manpower, and material to the completion of the installation.

B. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation of the Information Technology Cabinets, Racks, Frames and Enclosures described on the Drawings and/or required by these specifications.

C. The extent of the Information Technology Cabinets, Racks, Frames, and Enclosures Installation (The Project) will be as shown in the project drawings or as specified.

1.2 RELATED SECTIONS

A. The project's architects, engineers, contractors, manufacturers, and designers are responsible to be knowledgeable about the provisions contained within the following and other related sections of these standards of the Owner's IT department as they apply to the completion of the project's installation and design.
   1. Division 26 Electrical.
   2. Division 27 Communications.
   3. Division 28 Electronic Safety and Security.

B. Design, manufacture, test, and install the project's data cabling systems following the Owner's guidelines and standards, industry standards, and manufacturer's requirements and following NFPA 70 (National Electric Code), state codes, local codes, requirements of authorities having jurisdiction, and particularly the most recent editions of the following standards and specifications.
   1. Owner IT Design Guidelines and Standards
   2. National Fire Protection Association
   3. National Electrical Code
   4. National Electrical Safety Code
   5. This Technical Specification and Associated Drawings
   6. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises, and its published addenda.
   7. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, and its published addenda.
   8. ANSI/TIA-568-C.2, Copper Cabling Components Standard, and its published addenda.
   9. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, and its published addenda.
   10. ANSI/TIA/EIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces, and its published addenda.
   11. ANSI/TIA/EIA-606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, and its published addenda.
   12. ANSI/J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, and its published addenda.
   13. Building Industries Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM).
   14. ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centers, and its published addenda.
   15. Product manufacturer's published specifications and instructions.
   16. BICSI TDMM and associated standards.

PART 2 - PRODUCTS

2.1 PRODUCTS EQUIPMENT FRAMES

A. Approved four-post equipment racks (frames) are:
   1. Chatsworth Adjustable Quadra Rack™, 4-Post Frame for data equipment black unless otherwise specified.
   2. Frames shall be manufactured from aluminum and/or steel extrusion.

3. Each frame will have two L-shaped top angles, two L-shaped base angles, a top and bottom pan, and four C-shaped equipment-mounting channels (a front and rear pair). The rack will assemble with nut and bolt hardware. The base angles and bottom pan will be pre-punched for attachment to the floor. The top pan will be pre-punched for attaching the ladder rack with J-bolts.
4. Frames shall be manufactured from aluminum and/or steel extrusion and sheet.
5. Each frame will have two L-shaped top angles, two L-shaped base angles, a top and bottom pan, and four C-shaped equipment-mounting channels (a front and rear pair). The rack will assemble with nut and bolt hardware. The base angles and bottom pan will be pre-punched for attachment to the floor. The top pan will be pre-punched for attaching the ladder rack with J-bolts.
6. Equipment mounting channels will be 3” deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45 rackmount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
7. When assembled with top and bottom pans and angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The frame will include assembly and equipment-mounting hardware. Frames will include 100 each combination pan head, pilot point, and mounting screws.
8. The assembled frame will measure 19”w X 29” D X 7’. There will be 29” between the front and rear mounting surfaces of the two pairs of mounting channels. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the frame or for frame-to-frame or frame-to-rack baying (frames must be able to bay with a 2-post relay rack). Special Part number TS1051925 includes 4 post racks, a Horizontal Ground bar, and Rack Isolation Kit. Black is the standard color, but other colors may be requested.
9. The frame will be rated for 2,000 lb. of equipment.
10. The finish is standard Black.

B. Approved two post equipment racks (frames) are:
1. Chatsworth Universal Rack™, free-standing, 2-post rack, 19” inch x 7 feet high black when specified by Owner IT.
2. Install 2 post free-standing racks when specified and approved by the Architect or Engineer.
3. Racks shall be manufactured from aluminum and/or steel extrusions.
4. Each rack will have two L-shaped top angles, two L-shaped base angles, and two C-shaped equipment-mounting channels. The rack will assemble with bolt hardware. Equipment-mounting channels will be threaded for easy assembly. The base angles will be pre-punched for attachment to the floor.
5. Equipment mounting channels will be 3” deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45 rackmount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
6. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA (or 23” only when specified and approved by the Owner) rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The rack will include assembly and equipment- mounting hardware. Each rack will include 50 combination pan heads, and pilot point mounting screws.
7. The assembled rack will measure 7’ (84”) high, 20.3” wide, and 15” deep. The sides (webs) of the equipment-mounting channels will be punched to allow the attachment of vertical cable managers along the sides of the rack or for rack-to- rack baying.
8. The rack will be rated for 1,500 lb. of equipment.
9. The rack will be UL Listed.
10. The finish shall be an epoxy-polyester hybrid powder coat in the color of black.

C. Racks are to be joined vertically using the Chatsworth Global Vertical cabling solution part number 12831-703 (6”) and/or 12834-703 (10”) prior approved equivalent. One unit shall be installed on both sides of the racks.

D. For racks mounted “slab on grade” use Chatsworth Rack Base Insulator Kit.

E. The junction plate at top of the equipment frame shall be Chatsworth 10595-704.

F. Equipment Cabinets and Wall Mount Equipment Cabinets as specified and only when approved by the Owner.

G. Wall Mount Equipment Racks and Cabinets are permitted only with prior approval from the Owner.

2.2 VERTICAL WIRE MANAGEMENT

A. Vertical Cable Management for Racks/Frames (CCS Combination Cabling Section)
1. Every rack/frame will have a minimum of one vertical cable manager plus one additional per row. The vertical cable manager will create a space for storing and organizing cables and patch cords along the

side of the rack/frame. The cable manager will maintain separation between patch/equipment/jumper cords and premise cables.

2. The cable manager will be 12831-703 (6”) and/or 12834-703 (10”) installations as per required.
3. A single vertical cable manager shall be used in between bayed racks/frames.
4. The vertical cable manager will match the height of the rack(s)/frame(s).
5. The vertical cable manager will bolt to the side of racks/frames with included hardware.
6. The manufacturer of the vertical cable manager will sell compatible racks/frames.
7. The front cover will be removable.
8. The front of the vertical cable manager will have cable openings along both sides of the trough. The openings will be formed by evenly-spaced T-shaped cable guides. The T-shaped cable guides will be made from a composite plastic material (not metal) and will have rounded edges to protect the cables. When the cable manager is attached to a rack/frame, each cable opening will align with a rack-mount space (RMU) on the rack/frame. Each opening will pass a minimum of 24 each .25” OD patch cords.
9. The cable manager will be delivered individually boxed, and available in several widths as specified below and in the contract documents. 9. The vertical cable manager shall be manufactured from sheet aluminum and composite materials. 10. Finish shall be a black epoxy-polyester hybrid powder coat paint. Edge protectors, T-shaped cable guides, and latch hardware are black. Channels, Double-Sided, 10” Wide x 84” High x 14.6” Deep, Black.

2.3 EQUIPMENT

A. **THERE ARE NO NOTABLE EXCEPTIONS TO THE AFOREMENTIONED PRODUCT STANDARDS WITHOUT A WRITTEN CHANGE REQUEST SUBMITTED AND APPROVED BY THE OWNER.**

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 27 11 19 TERMINATIONS BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of termination blocks and patch panels as described on the Drawings and/or required by these specifications.

1.2 RELATED SECTIONS

A. Division 26 Electrical Division

B. Division 27 Communicants Systems

C. Division 28 Electronic Safety and Security

PART 2 - PRODUCTS

2.1 GENERAL

A. The materials and products specified herein reflect the minimum acceptable standards of fabrication and manufacture. All materials and products supplied by the Contractor and specified herein are to be new, unused, of first quality, and in original packaging or shipping containers and match the provided cabling system or as shown on drawings and described in Item 3.01.

B. New buildings and major renovations will be treated differently than existing buildings.

C. Approved horizontal cabling systems include those manufactured by:
1. Ortronics / Superior Essex
2. Leviton / Berk-Tek
3. Siemon / Siemon
4. Or as specified by the Architect/Engineer

D. In existing areas, cabling shall match the previously installed base cabling system, unless specified otherwise in project documents.

E. New building construction and owner-approved large-scale renovations will utilize Category 6 and/or Category 6E F/UTP cabling and matching termination hardware. Contact the Owner's Facilities Manager for approval of cabling systems before installation. All Category 6E cabling shall be a minimum of 23 AWG. 110 Termination Blocks for Copper Cables shall only be used for horizontal special applications (elevators, alarms Code Blue, etc.) and riser/distribution copper applications.

2.2 110 TERMINATION BLOCKS

A. The 110 termination system shall match the horizontal cabling system.

B. The 110 termination system shall include a wiring block, standoff legs, and vertical and horizontal wire management on all sides of the termination blocks. The system shall also include six (6) C-4's for 4-pair cable installations, and five (5) C-5's for 25-pair wiring strips, and labels.

C. Voice Patch Panels to be 8 position modular (8P4C), high density, 48 port, Pins (3, 4, 5, and 6), with Female Telco connectors. Connect patch panel with 25 pair tails terminating on 110 blocks.

D. The connection between terminal blocks is installed with a cross-connect wire.

2.3 BUILDING ENTRANCE TERMINALS and PROTECTOR BLOCKS

A. Circa 1880 ECA (110 to 110 connection) or 1880 B (cable stub) Type Multipair Protector Panels installed with Circa C3B1S 5 pin digital fault protected units or approved equal. Install per manufacturer's instructions.

B. The Contractor is required to confirm with the Owner before purchasing to ensure proper application for PBX and Equipment Room installations.

2.4 PATCH PANELS

A. Install category-compliant modular patch panels black in color.

B. In mixed-use applications (Category 6/Category 6E F/UTP) install modular F/UTP patch panels capable of supporting both applications.

C. Voice grade patch panels to be 8 positions (8P4C) modular, high density, 48 port, Pins (3, 4, 5, and 6), with Female Telco connectors. Connect patch panel with 25 pair tails terminating on 110 blocks.

D. E. The connection between terminal blocks is installed with a cross-connect wire.

E. Wire and Cable Management

1. Horizontal Wire Managers shall be black and 2 RU in size.

2. Vertical Wire Managers shall be black, a minimum of 6” wide x 9.30” deep with a removable cover, and shall also be compatible with the installed rack (CPI PN 12833-703 for reference).

3. Cable support managers are required at the rear of all patch panels.

2.5 FIBER ENCLOSURES, FIBER DISTRIBUTION UNITS (FDUs)

A. Rack Mounted FDU
1. Shall be sized according to fiber strand count.
2. FDUs shall be dedicated to each cable installed.
3. No cables shall be added to an existing FDU without prior approval of Owner IT.
4. Provide duplex LC coupler panels. Blue for SM, Aqua for 50um MM, and Beige for 62.5um MM.
5. Provide FDUs manufactured to include the required splice trays to support up to a 48-strand optical fiber able.
6. Provide separate splice tray enclosures for all cables over 48-strand optical fibers.
7. Provide fusible LC connectors or 1-meter simplex pigtail assemblies with LC connectors to match the installed optical fibers and splice at the FDU.
8. Vertical Wire Managers shall be black, a minimum of 6” wide x 9.30” deep with a removable cover, and shall also be compatible with the installed rack (CPI PN 12833-703 for reference).

PART 3 - EXECUTION

3.1 110 TERMINATION INSTALLATION

A. The 110-termination installation shall meet the manufacturer’s requirements and specifications to provide a 20-year warranty.

B. The ER and TR shall contain wiring blocks as required to terminate all incoming pairs and all outgoing pairs to all TRs.

C. Locate telephone wiring blocks on fire-treated plywood backboards as specified on the drawings or as specified herein.

D. Labeling for riser cables shall designate the corresponding destination TR wiring block.

3.2 PATCH PANEL INSTALLATION

A. The patch panel installation shall meet the manufacturer’s requirements and specifications to provide a 20-year warranty.

B. Each TR shall contain patch panels as required to terminate all pairs on its respective floor or floors served.

C. Install patch panels in 19” inch equipment racks as specified on the drawings or as specified herein.

D. Wire management is to be mounted at the top and bottom of station cabling equipment racks and between every patch panel.

E. Install no more than eight (8), 48 port patch panels (voice and data) per rack.

F. Include a vertical cable manager in between and on both sides of the equipment rack.

G. Patch panels for areas with a TR too small for an equipment rack shall utilize wall-mountable cabinets to mount the Chatsworth horizontal wire management and patch panels

3.3 OPTICAL FIBER ENCLOSURES, FDU INSTALLATION

A. The optical fiber enclosures and FDU installation shall meet the manufacturer's requirements and specifications to provide a 20-year warranty.

B. Install rack-mounted fiber FDUs at the top of the equipment racks where applicable.

C. Install 1 FDU per fiber bundle. No sharing of FDUs without prior approval of Owner IT.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 27 13 13 COPPER CABLE SPLICING AND OUTSIDE PROTECTED TERMINATIONS

PART 1 - GENERAL

A. The contractor, designated agent, or employee is held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation.

1.2 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the performance of multi-pair copper cable splicing as described on the contract documents and/or required by these specifications.

B. The contractor shall provide hardware for the grounding and bonding of cable and closures and all associated hardware necessary for the routing and management of communication cable in the vicinity of splices.

1.3 COORDINATION

A. The contractor shall coordinate the work specified in this Section with the work in other trades of the Project.

B. Plans in general are diagrammatic. It is the full responsibility of the Contractor to be familiar with the location of equipment involved under the work of other trades to eliminate conflicts between the copper splicing and the work of other trades.

C. All questions and issues concerning coordination shall be directed to Owner IT.

1.4 SUBMITTALS

A. All submittals shall be provided to the Architect/Engineer and approved before work proceeds.

B. Shop drawings shall include the manufacturer's printed information with each item. The information submitted shall include overall dimensions, weights, performance characteristics, and manufactured specifications. Shop drawings and Manufacturer's cut sheets where required shall be submitted by the Contractor to the Architect/Engineer for approval before installation.

C. Closure Supports, such as Threaded Rod and Channel Trapeze configurations can be fabricated on the job site if required.

1.5 STANDARDS FOR MATERIALS

A. All materials shall conform with the current applicable industry standards including, but not limited to:
   1. NEMA (National Electrical Manufacturers' Association)
   2. ANSI (American National Standards Institute)
   3. ASTM (American Society for Testing and Materials)
   4. ICEA (Insulated Cable Engineers Association)
   5. IEEE (Institute of Electrical and Electronic Engineers)
   6. National Electrical Safety Code

B. In addition, all Materials shall be Underwriters' Laboratories listed unless otherwise indicated.

1.6 QUALITY ASSURANCE

A. Verification: the Owner or Architect/Engineer will provide Quality Control Inspections on all Projects. It is incumbent upon the Contractor to verify that the installation and material used have been inspected before it is enclosed within building features, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected.

B. Equipment Qualifications: The Contractor is to use equipment and rigs designed for splicing, preparation, and drilling of closure end caps, drilling masonry, installing masonry anchors, etc., to install the splice supports and cable management hardware.

1.7 RELATED SECTIONS:

A. Division 26 Electrical

B. Division 27 Communications Systems

C. Division 28 Electronic Safety and Security

PART 2 - PRODUCTS

2.1 CLOSURES

A. The closure shall be designed to meet the following requirements.
   1. Accommodate the number of cables to be spliced.
   2. Watertight
   3. Meets the approved use of the manufacturer and application.
   4. Allow through splices with an equal number of cable entries.
   5. The splice closure shall be designed for multiple re-entries.
   6. Encapsulate shall not be used in indoor splice closures.
   7. Encapsulate shall be used within splices installed within manholes, handholes, or buried below grades.
   8. The Contractor shall use all parts, tool kits, and splice rigs specified by the splice closure manufacturer for the splice closure provided.
   9. Splice closures shall be submitted for approval to the Architect/Engineer before procurement.

B. Indoor closures for vaults, tip splices, service entrance facilities, risers, and building distribution systems shall be a complete flame retardant closure using manufacturer parts and installation procedures. Specify 3M 4-Type closures, 3M K&B Vault and Riser, or approved equal.

C. Buried splice closures shall be a complete closure designed for buried applications using manufacturer parts and installation procedures. Specify 3M Better Buried, 3M Scotch cast 89 Series Closures, or approved equal.

D. Underground and Tunnel closures where applications are not subject to water infiltration using manufacturer parts and installation procedures. Specify 3M 2-Types Closures or approved equal.

E. Aerial Closures shall be a complete closures designed for aerial applications using manufacturer parts and installation procedures. Specify 3M Z Watertight Closure System or approved equal.

2.2 COPPER CABLE SPLICE CONNECTORS

A. The splice connector shall be a modular splicing system with the following features and specifications.

   1. The splice connector shall be compatible with the 24 AWG PIC and DEPIC copper conductors, and 26 AWG protector fuse tails.
   2. The splice connector shall be part of a modular system that includes:
      a. Splice connectors.
      b. Bridge connectors.
      c. Half-tap connectors.
   3. The splice connector shall be manufacturer specified for use with 24 AWG PIC and DEPIC copper conductors, and 26 AWG protector fuse tails.
      a. The splice connector shall be dry for indoor applications.
      b. The splice connector shall be filled for use in outdoor applications.
      c. The splice connector shall have a capacity of 25 pairs for multiple- pair splices.
      d. The splice connector shall be constructed to allow multiple configurations based on a 2 or 3-piece standard assembly. The splice connector shall be 3M 710 Splicing System or 3M Micro Splice (MS2) 4000 Series Splicing Modules or the 710 modular equivalents, as appropriate for the closure and multiple pair splicing operations.
      e. The splice connector and system for single pairs splicing operations shall be 3M Scotch Lok Connectors and tools or approved equal.

2.3 MULTIPAIR COPPER CABLE IDENTIFICATION TIES

A. The Contractor shall use Panduit PIC color-coded cable ties included within the Panduit Cable Marker Kit part number PAN-TY PPC25X50F for identifying multipair copper cable binder groups within splice closures.

2.4 ENCAPSULANT

A. The Contractor shall inject 3M High Gel Re-Enterable Encapsulate in those closures specified. 3M Part Number 4442 or approved equal.

2.5 DAMMING COMPOUND

A. The Contractor shall apply damming compound over the end of filled copper cables once they are fanned out into splice closures intended for dry, indoor environments. 3M Haplec Blocking Compound, 3M Part Number 4408, or approved equal.

2.6 BONDING CONNECTORS

A. Scotch Lok Bonding Connectors, 3M Part Number Series 4460 or equivalent, shall be used to bond multipair copper cable jackets to appropriate ground copper.

2.7 CIRCUIT PROTECTION

A. Circa 1880 ECA (110 to 110 connection) or 1880 B (cable stub) Type Multipair Protector Panels installed with Circa C3B1S 5 pin digital fault protected units or approved equal. Install per manufacturer's instructions.

B. The Contractor is required to confirm with the Architect/Engineer before purchasing to ensure proper application for PBX and Equipment Room installations.

PART 3 - EXECUTION

3.1 CABLE SPLICING

A. The Contractor shall configure splice closures for straight splices in manholes or confined spaces unless otherwise approved by the Architect/Engineer.

B. The Closure shall be sized to ensure capacity for all pairs to be connectorized with appropriate splice modules, even if all pairs entering the closure are not to be spliced within the scope of the Project.

C. All 25-pair binder groups within each cable entering the splice closure are to be connectorized with splice modules. The Contractor shall use the same type and manufacture of connectors for all pairs. Splice modules will be installed according to the manufacturer's specifications. The foldback splice method shall be used for all splicing operations. The foldback's length shall be sufficient to fold to the opposite sheath opening and neatly assembled for uniformed splice module storage when the splice is closed.

D. When breaking out any multipair copper cable of 25 pairs or greater for splicing or termination, the binder groups shall have PIC color-coded cable ties and shall be labeled with cable designation and pair count attached to the cable at the point of fan out from supergroups for splicing, and at the point of fanout for termination on termination blocks. (Panduit Part Number PAN-TY PPC25X50F).

E. The Contractor shall ensure the cables to be spliced are routed into the closure in a manner observing the bend radii restrictions of the cables being spliced.

F. Install shield bond connectors to the shields of all cables entering the closure and bond to the grounding lug of the closure before sealing the closure assembly.

G. The splice shall be located in an area that will allow future access and re-entry. Stagger or offset the splice closures when more than one closure is installed in parallel within Utility Tunnels. Allow enough cable slack in all cables entering the closure to allow the dismounting of the closure from its supports and to ensure convenient access or reentry.

H. The Contractor shall apply an appropriate amount of damming compound over the end of filled copper cables in indoor or dry environments to prevent seepage of cable filling compounds where encapsulate will not be used.

I. Before closure assembly in dry or indoor installations, all exposed cable pairs shall have the filling compound thoroughly cleaned off the cable insulation or sheath using appropriate cleaning solvents.

J. All pairs spliced shall be tested per the Specifications, and all splice-related faults cleared before sealing the closure assembly.

K. Assemble the closure casing such that the hardware and fasteners are easily accessible without twisting or turning the cables.

L. Unfilled splice closures shall be sealed to provide air- and water-tight integrity and left unpressurized after the splices. Nitrogen gas shall be injected into the assembled closures and pressure tested to 6-10 psi for leakage.

M. Splice Closure Mounting
   1. Within Manholes: The contractor shall mount assembled closures to cable hooks and manhole racking between 18” and 48” inches above the floor of the structure, measured from the bottom of the enclosure canister. Mount closures on the manhole or handhole walls away from entrance conduits steps or handholds to avoid the splice closure being used as a step for ascent or descent. Do not install splice closures on walls that contain duct bank entrances or block entrance conduits on side walls.
   2. Within Utility Tunnels and Vaults: Placement in existing cable trays, attachment to racking, or attachment to stranded messenger may be required. The Contractor shall coordinate the location for the splice and alternative mounting techniques with the Architect/Engineer before cutting cables in preparation for splicing.

3.2 SPLICE CLOSURE LABELING

A. Label the assembled closure following the Architect/Engineer’s instructions.

B. All cables shall be labeled with cable designation, pair count including dead count, Contractor name, and date of completion within one foot of the splice case at each entrance and exit point of the splice case. Labels shall be mechanically printed and secured with stainless steel ties.

3.3 ACCEPTANCE AND TESTING

A. Physical inspection requirements include:
   1. Installation evaluation
   2. Placement and support
   3. Conduits seals
   4. Splices – bonding, color coding, neatness, fold back
   5. Splice cases – NEC and Manufacturer’s instructions
   6. Grounding and bonding including continuity to each cable
   7. Waterproofing compound
   8. Labeling
   9. Photographs of splice before closure. Include images of the splice bonding apparatuses.
   10. Cleanup

B. Testing and documentation requirements include:
   1. Line mapping result: Pass/Fail
   2. Proper wiring configuration for cable pairs and bundles
   3. Open conductors – provide footage for failures
   4. Split pairs
   5. Reversed pairs
   6. Shorts – provide ohms & provide loop resistance in ohms
   7. Grounds – provide ohms & distance to fault on failures
   8. Crossed pairs
   9. Grounds and bonds – provide ohms measurement

C. Provide all test results in the following format.
   1. Two (2) copies in electronic format on CD or Thumb Drive
   2. Provide test results in EXCEL Format

D. Provide as-builts in the original format provided.

END OF SECTION

SECTION 27 13 23 COMMUNICATIONS FIBER OBTIC BACKBONE CABLING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of fiber optic backbone infrastructure as described on the drawings and/or required by these specifications.

1.2 RELATED SECTIONS

A. Division 26 Electrical

B. Division 27 Communications Systems

C. Division 28 Electronic Safety and Security

1.3 COORDINATION

A. The contractor shall coordinate the work specified in this Section with the work in other parts of the Contract document.

B. Plans in general are diagrammatic. It is the full responsibility of the Contractor to be familiar with the location of equipment involved under the work of other trades to eliminate conflicts between the fiber optic cable installation and the work of other trades.

C. All questions and issues concerning coordination shall be directed to the Architect/Engineer.

1.4 SUBSTITUTIONS

A. The intent of the specifications are:

1. Where specified only by reference standards, select any approved product meeting the standards of any manufacturer.

2. Where specified by naming several products or manufacturers, select any approved product and manufacturer named that meets the specified requirements. Other products and manufacturers will not be considered.

3. Where specified by naming one or more products or manufacturers, but indicating "or equivalent" after the specified listing, the specified product is the preferred quality standard. The Contractor may submit a request for another product for acceptance.

4. Where specified by naming only one product and manufacturer: There is no option, and no substitution will be allowed.

B. Submit requests for substitutions within 10 days of contract award, or sooner if required to maintain the construction schedule.

C. The Contractor must submit sufficient information to show that a proposed substitute is equivalent to the item specified. Acceptance of substitutions is at the Architect/Engineer’s discretion: Architect/Engineer reserves the right to determine the suitability of the substitute product and reject any materials submitted for substitution. All substitute products and materials must be approved for substitution by the Architect/Engineer in writing before installation. Products rejected or otherwise judged unsatisfactory by the Architect/Engineer will not be authorized for use in completing the Work. Any unapproved products discovered as part of the installation will be removed and replaced with specified and approved products at the Contractor’s expense.

D. Project Drawings may be based on the equipment configuration of a particular manufacturer. If a substitution is approved, the Contractor shall make changes needed to accommodate the substitution at no expense to the project, including work under other divisions.

1.5 QUALITY ASSURANCE

A. Verification: the Owner will maintain inspection personnel on the job site. It is incumbent upon the Contractor to verify that the installation and materials used have been inspected by Owner IT before it is enclosed within building features or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected by the Architect/Engineer.

B. Equipment Qualifications: The Contractor shall use equipment and rigs designed for pulling, placement, and termination of backbone cable; including reel trucks, mechanical mules, sheaves, shoes, anchors, etc., and equipment for drilling masonry, installing anchors, etc., to install support and cable management hardware.

PART 2 - PRODUCTS

2.1 SINGLE-MODE FIBER CABLE

A. Furnish all required single-mode fiber (SMF) OS1, steel armored, OSP-rated cable per Architect/Engineer request.

B. Furnish all required single-mode fiber (SMF) OS1, blown fiber (ABF), and properly rated cable per Architect/Engineer request.

2.2 MANUFACTURER

A. Approved Manufacturers:

1. OSP -Ortronics/Superior Essex, Bertek, when specified
2. ABF -AFL / Dura-Line ABF
3. Sumitomo when specified

PART 3 - EXECUTION

3.1 FIBER OPTIC INSTALLATION

A. This Section describes the installation locations for the products and materials, as well as methods and Standards associated with the Telecommunications Installation portions of the Project. These Specifications, along with the drawings and other supplied specifications shall be followed during the installation.

B. All products shall be installed following the manufacturer’s requirements.

C. The Contractor is instructed to coordinate his efforts with the other tradesmen who may be working within the same vicinity to avoid conflict and lost time.

D. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.

E. The Contractor shall verify space requirements and locations with site conditions before starting cable installations and terminations.

F. The Contractor shall verify the cable type and jacket rating required with the Owner before starting fiber installation.

G. The Contractor shall verify existing cable fill in conduit, raceway, or cable tray system before installation of additional cables so as not to exceed 40% cable fill. The contractor will be responsible for the installation of additional conduit, raceway, and cable tray where additional cables to be added will exceed the 40% cable fill. See cable fill attachment, 3.1 Attachment #1.

H. Verify that field measurements and cable routing and termination conditions are as shown on construction drawings conjoined with this specification. Provide notification, in writing, of conditions deviating from drawings.

3.2 FIBER AND TERMINATION PANEL LABELING

A. Label the installed cables following Division 27, Section 27 05 53 - Identification for Communication System.

3.3 CABLE SUPPORT

A. Stainless Steel strapping is required for cable banding applications that require various bundle sizes.

B. Provide cable supports and clamps to attach cables to backboards and walls.

C. Attach horizontal and vertical backbone cables at a maximum of three feet intervals using Architect/Engineer-approved supports to avoid cable sagging.

D. All entrance cables shall have a minimum of a six feet slack loop up to the protector block.

E. Attach cables to manhole racks using Owner-approved methods.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 27 14 13 COPPER RISER AND INTRABUILDING CABLING

PART 1 - GENERAL

A. The Contractor are held responsible to be familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation.

1.1 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of copper riser infrastructure as described on the Drawings and/or required by these specifications.

1.2 RELATED SECTIONS

A. Division 26 Electrical

B. Division 27 Communications Systems

C. Division 28 Electronic Safety and Security

PART 2 - PRODUCTS

2.1 COPPER RISER CABLING

A. Riser Cable (Voice) - Provide riser cables from the ER/BDF to each TR/IDF as indicated on Drawings or as indicated herein.
   1. Riser cables shall consist of twenty-five pair bundled unshielded twisted pairs, 24-gauge, solid copper Category 3 rated. The jacket shall be CMR (ARMM) or CMP- rated to meet the application of the environment. The size of the cables and shielding will be determined by the project's requirements.
      a) Category 5E Power Sum Riser Cables requirements are project specific.
   2. Manufacturer shall be Superior Essex or Bertek by specification only.

B. Riser Termination Blocks and Patch Panels
   1. See Section 27 11 19 - Termination Blocks and Patch Panels

PART 3 – EXECUTION

3.1 TELECOMMUNICATIONS INSTALLATION

A. This Section describes the installation locations for the products and materials, as well as methods and Standards associated with the Telecommunications Installation portions of the Project. These Specifications, along with the drawings, shall be followed during the installation.

B. The Contractor is instructed to coordinate his efforts with the other tradesmen who may be working within the same vicinity to avoid conflict and lost time.

C. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.

D. The Contractor shall verify space requirements and locations with the Owner before starting cable installations and terminations.

E. The Contractor shall verify the cable type and jacket rating required before starting the riser cable installation.

F. The Contractor shall verify new conduit cable fill in riser conduit so as not to exceed 40% cable fill. The contractor shall notify the Architect/Engineer if the existing riser conduit will meet or exceed the 60% cable fill. The Architect/Engineer will determine if additional conduits are required.

3.2 RISER CONDUITS

A. Provide a measure marked 1320 tensile strength mule tape in each empty conduit to facilitate future installation of cables.

B. Communication pathways requiring fire stopping shall utilize re-enterable fire-stopping systems as per section 27 05 28.2 - Pathways.

C. All fire-stopping penetrations shall conform to the recommended practices listed in UL1479 or ASTM E814 and must be labeled with the UL1479 or ASTM E814 reference number, dated, and signed by the technician who installed the fire-stopping material.

3.3 RISER COPPER CABLING

A. The Category 3 copper riser cabling will be terminated at the ER/BDF and TR/IDF on 110-type wiring blocks.
   1. A second set of 110 blocks shall be installed where the 25-pair pre-connectorized tails go to a voice-rated patch panel located near the top of the racks, and above the horizontal cable patch panels.
   2. A third set of 110 blocks shall be installed where life safety cables are installed.
   3. These blocks utilize cross-connection wires to complete the circuits.

B. Category 6E Power Sum cabling shall be terminated such that wire pair twists are maintained as closely as possible to the point of mechanical termination. No greater than 0.5. Maintain cable sheath to the leading edge of the connector block.

3.4 GENERAL CABLE INSTALLATION

A. Cable bends shall not be greater than that recommended by the manufacturer of the cable. Ensure the cable sheath is not deformed, perforated, kinked, or damaged in any manner.

B. Care shall be taken so as not to damage the cable during the installation process and that manufacturer's pull tension specification is not exceeded. The damaged cable shall be replaced with a new one.

C. When breaking out any multi-pair copper cable of 25 pairs or greater for splicing or termination, the binder groups shall have PIC color-coded cable ties attached to the cable at the point of fan out from supergroups for splicing, and at the point of fan out for termination on termination blocks. (Panduit Part Number PAN-TY PPC25X50F)

D. Bond all metallic cable sheaths to the room's Telecommunications Main Ground Bar.

E. Provide individual riser cables to each floor.

F. Within TRs, cables shall be snugly wrapped using Velcro reusable cable ties, a minimum of every 3 feet inches for cable organization. Wire ties shall only be used on OSP cables and shall be tightened so as not to deform cable jackets and thus affect cable performance.

G. Cable fill in riser conduits shall not exceed 40% cable fill on initial installation.

H. New TRs must be free from dust, dirt, and other foreign materials before the installation of any termination hardware or the termination of copper or fiber optic cables. The door to the telecommunication rooms must be installed and closed during the termination and locked when not occupied. The Contractor is responsible for theft and damages when the IT Room is not locked and secured.

3.5 CABLE TESTING AND ACCEPTANCE

A. The vertical multiple-pair copper riser cables shall be tested and documentation should be provided to the Architect/Engineer.

B. Physical inspection requirements include:
   1. Installation evaluation
   2. Placement and support
   3. Conduits seals
   4. Splices – bonding, color coding, neatness, fold back
   5. Splice cases – NEC and Manufacturer's instructions
   6. Grounding and bonding
   7. Waterproofing compound
   8. Labeling
   9. Cleanup

C. Testing and documentation requirements include:
   1. Line mapping result: Pass/Fail
   2. Proper wiring configuration for cable pairs and bundles

3. Open conductors- Shall be repaired
4. Split pairs
5. Reversed pairs
6. Shorts – provide ohms & provide loop resistance in ohms
7. Grounds – provide ohms & distance to fault on failures
8. Crossed pairs
9. Pair Integrity – the Owner expects 100% Pair Integrity.
10. Verify red lines or provide as-builts to submittals of the installation.

D. Provide all test results in the following format.
   1. Electronic test reports and summary pages shall be submitted in a readable format to the Owner.

3.6 EQUIPMENT INSTALLATION AND CABLE TERMINATIONS

A. All equipment shall be installed in a neat and workmanlike manner, arranged for convenient operation, testing, and future maintenance.

B. All paired cables shall be installed and terminated by technicians experienced in the termination of cables on 110/66 connector blocks in the proper color code sequence.

C. The Contractor shall employ manufacturer-certified system installation technicians who have at least 5 years of experience in the installation of similar and equivalent systems. The Contractor shall supply verification of experience, for this type of work, to the Owner for approval before performing any work.

D. All cables shall be installed, terminated, and labeled in sequential order.

3.7 AS-BUILT INFORMATION

A. The contractor shall provide as-built information to the Owner to accompany all test result information.

B. As-built information shall be submitted to the Owner in electronic PDF format. Indicate the location of all riser conduit routes, distribution cable trays, junction boxes, and all additions and deletions related to telecommunications. Include riser labeling next to all telecom symbols (symbols are from the national CAD Standard and BICSI).

C. If construction drawings are not utilized, the Contractor shall provide all telecommunications location information on an accurately scaled floor plan.

D. The contractor shall perform all labeling requirements and provide testing documentation for verification as described herein.

E. The contractor shall submit cable records to reflect all moves, adds, and changes

3.8 SYSTEM WARRANTY REQUIREMENTS

A. The Contractor shall provide a 20-year Warranty for parts and labor on all riser cable installs.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 27 15 23.2 FIBER OPTIC HORIZONTAL CABLING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of horizontal optical fiber infrastructure as described on the Drawings and/or required by these specifications.

1.2 RELATED SECTIONS

A. Division 26 Electrical

B. Division 27 Communications Systems

C. Division 28 Electronic Safety and Security

PART 2 – PRODUCTS

2.1 FIBER CABLING

A. Single-mode Fiber Optic Outlet Cable - Provide horizontal fiber optic cable from the outlet through conduits to the cable tray and then through the cable tray to TR or ER.

B. Each single-mode fiber optic cable shall be a MIC-type tight buffered fiber. Typical fiber outlets consist of a two-strand fan out type. The number of strands may vary depending on the project.

C. Multimode Fiber Optic Outlet Cable - Provide horizontal fiber optic cable from the outlet through conduits to the cable tray and then through the cable tray to TR or ER.

D. Each multimode fiber optic cable shall be a MIC-type tight buffered fiber. Typical fiber outlets consist of a two-strand fan-out type fiber. The number of strands may vary depending on the project.

2.2 MANUFACTURER

A. Approved Manufacturers:
   1. Ortronics/Superior Essex
   2. AFL / Dura-Line
   3. Ber-Tek

PART 3 – EXECUTION

3.1 FIBER OPTIC CABLE INSTALLATION

A. This Section describes the installation locations for the products and materials, as well as methods and Standards associated with the Telecommunications Installation portions of the Project. These Specifications, along with the drawings, shall be followed during the installation.

B. The Contractor is instructed to coordinate his efforts with the other tradesmen who may be working within the same vicinity to avoid conflict and lost time.

C. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.

D. The Contractor shall verify space requirements and locations with the Owner before starting cable installations and terminations.

E. The Contractor shall verify the cable type and jacket rating required before starting fiber installation.

F. The Contractor shall verify existing cable fill in conduit, raceway, or cable tray system before installation of additional cables so as not to exceed 40% cable fill. The contractor will be responsible for the installation of additional conduit, raceway, or cable tray where additional cables to be added will exceed the 40% cable fill. See cable fill attachment, 3.1 Attachment #1.

3.2 EMPTY STATION CONDUITS

A. Provide a nylon pull cord in each empty conduit and extended it in the raceway to openings for faceplates to facilitate future installation of cables.

3.3 HORIZONTAL FIBER CABLING

A. The horizontal fiber cabling will be terminated at the TR or ER in a rack-mountable enclosure.

B. The contractor is responsible to obtain and follow manufacturer installation instructions for cable installation, correct termination, and fiber management of cables.

3.4 FIBER COLOR CODES

A. Fiber Color Code
1. Blue
2. Orange
3. Green
4. Brown
5. Slate
6. White
7. Red
8. Black
9. Yellow
10. Violet
11. Rose
12. Aqua

3.5 GENERAL FIBER INSTALLATION

A. Cable lengths within boxes shall be adequate to permit installation and removal of the device for inspection without damage to cable or connections (minimum of 12”).

B. Cable bends shall not be greater than that recommended by the manufacturer of the cable.

C. Care shall be taken so as not to damage the cable during the installation process and that manufacturer’s pull tension specification is not exceeded.

D. Route cables so that no horizontal cable exceeds 90 meters between TR termination and device jack termination.

E. Provide a minimum of 8’-0” and a maximum of 10’-0” of slack. Loop at the TRs shall be contained within the fiber enclosure.

F. Within TRs, cables shall be snugly wrapped using Velcro reusable cable ties, a minimum of every 3’-0” for cable organization. Velcro ties shall be tightened so as not to deform cable jackets and thus affect cable performance.

G. Cable fill in station conduits, raceway, and cable tray shall not exceed 40% cable fill.

H. New TRs must be free from dust, dirt, and other foreign materials before the installation of any termination hardware or the termination of copper or fiber optic cables. The door to the telecommunication rooms must be installed and closed during termination. The door shall be locked when unoccupied. The IT room shall be dust free during the termination process and remain so thereafter.

3.6 CABLE TESTING

A. A 100% verification by the Contractor of all horizontal fiber cable tests will be performed. The Contractor shall notify the Owner before the start of testing. The fiber optic cables shall be tested utilizing a power meter and stabilized light source capable of testing at 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single mode. The contractor shall complete a fiber optic post-installation report at the time of testing containing meter readings at both 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single mode in one direction (TR to outlet) on each fiber. Actual loss and other pertinent data regarding the cables tested, including model and the serial number of test equipment, cable part #, installed fiber length, building span loss at 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single-mode and date tested. The fiber optic post-installation report shall be in a form substantially similar to 3.7 Attachment 1. The testing

required is 100%. Place in a 3-ring binder, preceded by a tabbed divider, and label as “Horizontal Fiber”. Span loss calculations are required on the final test sheet for loss at 850 nm and 1300 nm for multimode and 1310nm and 1550nm for single mode.

(D x L) + (C x # connectors)

D = Length; L = Loss; C = Connector loss (Max 0.5 dB)

1 ft. = Per Part NO. & Manufacturer Specification

B. The Owner will perform random verification testing as part of the acceptance of all fiber optic cable testing.

3.7 EQUIPMENT INSTALLATION AND CABLE TERMINATIONS

A. All equipment shall be installed neatly and professionally and arranged for convenient operation, testing, and future maintenance.

B. All fiber cables shall be installed and terminated by technicians experienced in the installation and termination of fiber cables.

C. The Contractor shall employ certified system installation technicians and have at least 5 years of experience in the installation of similar and/or equivalent systems.

D. The Contractor shall supply verification of experience, for this type of work, to the Architect/Contractor for approval before performing any work.

3.8 AS-BUILT INFORMATION

A. The contractor shall provide as-built information to the Owner to accompany all test result information.

B. As-built information shall be in electronic format (PDF). Indicate the location of all outlets, distribution cable trays, junction boxes, and all additions and deletions related to telecommunications. Include correct outlet labeling next to all telecom symbols.

3.9 SYSTEM WARRANTY REQUIREMENTS

A. All work shall be done to the Manufacturer’s warranty requirements.

B. The contractor shall perform all labeling requirements and provide testing documentation for verification as described herein.

C. The contractor shall submit cable records to reflect all moves, adds, and changes.

D. The contractor shall provide floor plans showing the locations of all telecommunication outlets and spaces.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 27 15 43 FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work covered by this Section shall consist of furnishing all labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of faceplates and connectors as described on the Drawings and/or required by these specifications.

1.2 RELATED SECTIONS

27 05 28.2	Pathways
27 05 53	Identification for Communication Systems
27 11 16	Cabinets, Racks, Frames, and Enclosures
27 11 19	Termination Blocks and Patch Panels
27 13 13	Copper Cable Splicing and Outside Protected Terminations
27 13 23	Fiber Optic Backbone Cabling
27 15 23.2	Fiber Optic Horizontal Cabling

PART 2 - PRODUCTS

2.1 PRODUCTS STANDARD

A. The materials and products specified herein reflect the minimum acceptable standards of fabrication and manufacture. All materials and products supplied by the Contractor and specified herein are to be new, unused, of first quality, and in original packaging or shipping containers or as shown on drawings and described in Item 3.01.

B. New buildings and major renovations will be treated differently than minor remodels in existing buildings.
   1. Match existing cabling systems and termination hardware for all adds moves and changes with a minimum of Category 6E (Superior Essex Series 66 or as specified) termination hardware including voice and data unless directed otherwise by the Owner, even those areas where separate voice and data closets are utilized.
   2. New building construction and renovations will utilize a minimum of Category 6E termination hardware or as specified by the Owner.

C. Contact the Owner for approval of cabling systems before installation. Verify exact cabling requirements with the Architect/Engineer.

D. The Owner will provide patch cords and make all connections to the campus network and phone system unless otherwise specified.

E. The standard work area outlets consist of 2 Category 6E ports.

F. Wall phones shall consist of 1 Category 6E connector to be installed within a single gang, modular one-port stainless steel faceplate.

G. Wireless TOs mounted in ceilings have 2, Category 6E connectors.

2.2 STANDARD TELECOMMUNICATIONS OUTLET (TO)

A. Standard work area Telecommunications Outlets (TO) shall utilize blue modules/inserts with 45°-degree angled jacks and faceplates and blanks shall be white or shall match the color of electrical faceplates. Floor boxes require flat jacks.

B. Approved Manufacturers and products shall be:
   1. Ortronics
   2. Leviton
   3. Siemen
   4. Or as specified

C. Horizontal Fiber Terminations:
   1. At the TO and in the TR, use the manufacturer's matching module and the type of connector as required by the application, LC mechanical connectors, or match existing.

2. The link Loss budget shall meet all manufacturers' specifications.

D. Existing Copper TO Locations:
1. Where new jacks are being installed in existing TO locations, match with the existing connector hardware and patch panel manufacturer.

E. CATV Terminations
1. Coaxial RG-6 Cable Installations
a. Terminate all RG-6 cables with F-type crimp or compression connectors and correctly sized tools.
2. CATV outlet within a TO shall utilize F type insert module.

PART 3 - EXECUTION

3.1 GENERAL

A. This Section describes the installation locations for the products and materials, as well as methods and Standards associated with the IT Installation portions of the Project. These Specifications, along with the drawings and other specifications shall be followed during the installation.

B. The contractor is required to be currently listed as an approved manufacturer registered Certified Installer and provide personnel for IT installations who are certified and meet warranty requirements established by the manufacturer.

C. The Contractor is instructed to coordinate his efforts with the other tradesmen who may be working within the same vicinity to avoid conflict and lost time.

D. The Contractor is required to supply all necessary tools, equipment, accessories, safety equipment, protective clothing, etc., as customary for the craft and necessary for the installation.

E. The Contractor shall verify space requirements and locations with the Owner and/or the Architect/Engineer before starting cable installations and terminations.

F. All terminations are to use TIA T568B wiring standards.

G. Terminate according to the manufacturer's instructions

3.2 TERMINATIONS

A. Twisted pair cable.
1. All twisted pair cables shall be terminated as specified by the manufacturer with the proper tools.

B. Coax Cable
1. All Coax cables shall be terminated using connectors matching cable type and application, tool assembly matching connector type for crimp or compression type connectors, and follow Manufacturer procedures for termination.

C. Optical Fiber Cable.
1. Optical Fiber terminated at the desktop will be with LC connectors following the manufacturer's instructions. Optical fiber terminated in TR/ER shall be fusion type LC connectors or fusion spliced pigtails using LC connectors when specified, on all new projects, and existing projects where optical fiber is being added confirm in writing the connector type with the Architect/Engineer.

3.3 EQUIPMENT INSTALLATION AND CABLE TERMINATIONS

A. All equipment shall be installed in a neat and workmanlike manner, arranged for convenient operation, testing, and future maintenance.

B. All telecommunications cables, faceplates, and connectors shall be installed and terminated by manufacturer-certified technicians experienced in the installation and termination of telecommunications items listed herein.

C. The contractor shall provide licensed manufacturer-certified technicians and installers.

3.4 AS-BUILT INFORMATION

A. The Contractor shall provide 1 set of preliminary as-built information to the Owner, along with all test result information 2 weeks before occupancy or substantial complication. Partial as-builts shall be submitted as

cabling is completed. A final as-built shall be submitted with all corrections made a maximum of 30 days after the cabling installation is complete.

B. As-built information shall be in electronic DWG and PDF format. Indicate the location of all TOs, pathways, distribution cable trays, junction boxes, and all additions and deletions related to telecommunications. Include correct TO labeling next to all telecom symbols.

C. If construction drawings are not utilized, the contractor shall provide all telecommunications location information on an accurate and scaled floor plan.

3.5 SYSTEM WARRANTY REQUIREMENTS

A. The Contractor shall perform all labeling requirements and provide testing documentation for verification as described herein.

B. The Contractor shall submit cable records to reflect all moves, adds, and changes.

C. The Contractor shall provide floor plans showing the locations of all telecommunication outlets and spaces.

D. The Contractor shall perform these requirements for category 6 and 6A permanent link configurations and submit to the hardware manufacturer such paperwork and test results as necessary to obtain a minimum 20-year system performance guarantee as defined by the cable and hardware manufacturers. The 20-year minimum system warranty shall be provided to the Owner before final payment for this work.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 28 00 00 ELECTRONIC SAFETY AND SECURITY INDEX

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish all labor, equipment, materials, service tools, etc., which are required for the complete installation of all Electronic Safety and Security work, as indicated on the Drawings and specified herein. Electronic Safety and Security work indicated on the Drawings and/or specifications covering other trades shall conform to Division 28 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Electronic Safety ad Security systems, shall be accomplished without additional cost to the Owner.

1.3 ELECTRONIC SAFETY AND SECURITY DIVISION INDEX

280500	GENERAL ELECTRONIC SAFETY AND SECURITY PROVISIONS
283000	FIRE ALARM SYSTEMS

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 28 05 00 GENERAL ELECTRONIC SAFETY AND SECURITY PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment, and workmanship shall conform to the applicable provisions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC), Occupational Safety and Health Act (OSHA) all local, state, and national codes, ordinances and regulations governing the particular class of work involved and the terms and conditions of the electrical utility and other authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations, and authorities shall be made by the Contractor without additional charge to the Owner. The Contractor shall secure all permits and licenses required for their work and shall pay all fees in connection with such permits and licenses.

B. On completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved; and, on completion of the work, the Contractor shall obtain and deliver to the Owner, final certificates of acceptance. The Contractor shall furnish copies of each certificate to the Architect/Engineer.

C. Underwriter's Laboratories (UL): All materials, appliances, equipment, or devices shall conform to the applicable standards of Underwriter's Laboratories, Inc. where such standards have been established.

D. Standards: The current edition of the following specifications and standards shall form a part of these specifications:
1. National Fire Protection Association Standards
2. National Electrical Code, NFPA 70 (NEC)
3. Life Safety Code, NFPA 101
4. NFPA 72
5. Occupational Safety and Health Act (OSHA)
6. National Electrical Safety Code (NESC)
7. Underwriter's Laboratories, Inc. (Standards)
8. American National Standards Institute (ANSI)
9. American Society of Testing and Materials (ASTM)
10. Institute of Electrical and Electronic Engineers (IEEE)
11. Insulated Cable Engineer's Association (ICEA)
12. National Electrical Manufacturer's Association (NEMA)
13. Americans with disabilities Act Accessibility Guidelines (ADA)

1.3 DRAWINGS

A. The electrical drawings show the general arrangement of all conduit, outlets, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. The architectural and structural drawings shall be considered as a part of the work insofar as these drawings furnish the Contractor with information relating to the design and construction of the building. Architectural drawings shall take precedence over electrical drawings. Because of the small scale of the electrical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange their work accordingly, providing such fittings, elbow, pullboxes, and accessories as may be required to meet such conditions.

B. The Contractor shall verify the dimensions governing the electrical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings.

C. Drawings and specifications shall be considered as complementary. Work or materials called for by one and not mentioned in other shall be provided as though treated by both.

D. In the case of conflict between drawings and specifications, the greater or more restrictive requirement shall apply.

E. Any question as to the intent of the drawings or specifications shall be referred to the Architect/Engineer, whose decision shall be final and conclusive.

F. Should the Contractor observe any conflict or variation in the plans and specifications, they shall notify the Architect/Engineer in writing no later than seven (7) days prior to date of bid opening. Failure to clarify such variations will result in the Contractor bearing all costs arising from electrical work necessary to resolve the conflict or variation.

1.4 AS-BUILT DRAWINGS

A. During progress of the work, the contractor shall maintain an accurate record of the installation of the system, locating each outlet, and note all circuiting deviations from the contract drawings. Upon completion of the installation, the contractor shall transfer all record data to a single neat and legible set of blue line prints of the original drawings.

1.5 OPERATING INSTRUCTIONS AND MANUALS

A. Instructions: Without additional charge to the Owner, furnish competent instruction to the Owner in the care, adjustment, and operation of all parts of the electrical equipment and systems.

B. Manuals: Upon completion of the work, prepare and deliver to the Owner two (2) sets of complete operating and maintenance manuals for the systems and major equipment installed, suitably bound in book form and must be originals. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data.

C. Other: The above requirements are in addition to specific instructions and manuals specified for individual systems or equipment.

1.6 SITE VISIT

A. The Contractor shall visit the site prior to bidding and satisfy themself as to the conditions under which the systems are to be installed. No subsequent allowance shall be made on their behalf for failure to make such a visit.

1.7 FIELD MEASUREMENTS

A. The Contractor shall verify the dimensions covering the work. No extra compensation shall be claimed or allowed due to difference between actual dimensions and those indicated on the drawings. No waiver of responsibility for defective work shall be claimed or allowed due to failure to report unfavorable work conditions affecting the work.

1.8 PERFORMANCE TESTS

A. Thoroughly test all fixtures, batteries, services, and all circuits for proper operating condition, required durations and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances and devices shall be operated under load conditions.

B. After the interior wiring system installation is complete and at such time as the Architect/Engineer may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices, and equipment after installation, to assure that all material continues to possess all the original characteristics as required by governing codes and standards listed in these specifications.

C. Perform such other tests as required by other sections of these specifications or as requested to prove acceptability.

D. Furnish all instruments and labor for testing.

1.9 REMODELING WORK

A. Where remodeling work is indicated, the Contractor shall be responsible for all electrical work associated with changes in, or removals of existing walls, ceilings or floors. This work shall include rerouting of conduits, relocation of fixtures, devices and conduits as well as provision for circuit continuity for circuits in remodeled

areas. The cost of all of this work shall be included in the Contractor's price with no additional compensation allowed for failure to include this work.

1.10 MISCELLANEOUS ITEMS

A. Miscellaneous items not covered in these specifications shall be as indicated on the drawings, installed and connected in the proper manner and as recommended by the manufacturer.

1.11 GUARANTEE

A. All equipment and workmanship to be furnished under this contract shall be guaranteed for a period of one year from the date of final acceptance thereof against defective materials, design, and workmanship. Upon receipt of notice from the Owner of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the Contractor. The labor incident to the installation of these replacements shall be furnished by the Contractor.

1.12 STANDARDS OF MATERIAL AND WORKMANSHIP

A. All material shall be new and shall bear the label of the Underwriter's Laboratories, Inc., or be listed under re-examination service. All material shall be of the best grade and latest pattern of manufacture as specified. All work shall be performed in a neat, workmanlike manner and shall present a neat mechanical appearance when completed.

PART 2 - PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

A. The electrical requirements for equipment specified or indicated on the drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the electrical drawings, the Contractor shall make all adjustments to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective section of this specification under which the equipment is furnished.

2.2 MATERIALS

A. When the product of a specific manufacturer is indicated on the drawings or specified herein by catalog number or trade name, it has been done for convenience in fixing the standard for workmanship, finish, design, and the guaranteed performance. Any material, apparatus, or appliance which the Contractor desires to substitute for those mentioned herein shall also conform to these standards or exceed them and shall follow the procedure as outlined under substitutions and specified herein.

B. All similar materials and equipment shall be the product of the same manufacturer.

C. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the contract requirements and meets the approval of the Architect/Engineer.

D. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.

E. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the project site.

2.3 NAMEPLATES

A. All items of mechanical and electrical equipment shall be identified by the attachment of engraved nameplates, constructed from laminated phenolic plastic, at least 1/16" thick, three-ply, black surface and white core. Plates shall be attached by the use of stainless plate screws unless indicated otherwise. Nomenclature on the label shall include the name of the item and feeder circuit number. Equipment to be labeled shall include, but not be limited to, the following:
   1. Air Conditioning Control
   2. Contactors

3. Panels and Switches
4. Time Switches
5. Relays
6. Disconnect Switches
7. Starters
8. Transformers
9. Miscellaneous
10. Similar and/or related items

2.4 CHANGES

A. No changes shall be made in the electrical work as shown and herein specified, unless such changes are authorized in writing by the Architect/Engineer and such authorization shall contain a statement covering the amount of the charges involved in the change.

2.5 SUBSTITUTIONS

A. On all material, substitutions will be considered only if requested by letter from the Contractor to the Architect/Engineer. Letters must be in the engineer's office no later than 10 days prior to the bid date and shall be considered as authorized only upon written confirmation from the Architect/Engineer. Where materials are proposed to be substituted in lieu of the items specified, substitutions shall be equal in quality, workmanship, and design. The burden of proof of equality of materials shall be placed upon the Contractor. Samples of all materials proposed for substitution shall be submitted to the Architect/Engineer, when requested, for examination.

2.6 SHOP DRAWINGS

A. Shop drawings shall be furnished for all equipment and materials. They shall be furnished by the Contractor as required in the Submittal Section. Where equipment will be furnished "as specified," a statement to that effect is sufficient. Where substitutions are proposed, complete data must be furnished showing performance, quality, and dimensions.

B. The Contractor shall submit to the Architect/Engineer for checking a complete descriptive and technical data list for all items of material furnished under this contract. Complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation shall be shown. Fixture submittals shall include scale drawings showing metal gauges and finish together with complete photometric distribution curves and coefficient of utilization tables. Glare factor curves shall also be submitted for each fixture. Failure to submit this information can be the basis for disapproval.

C. All descriptive and technical data and shop drawings shall bear signed certification that they have been carefully examined and found to be correct with respect to dimension, space available, non-interference with other trades and that the equipment complies with all the requirements of these specifications. Submittals that have not been checked for compliance will not be considered by the Engineer.

D. Only complete submittals will be considered, partial submittals will not be reviewed.

2.7 SUBMITTALS

A. Submittals shall be complete; bound booklets with an index of all items submitted including associated catalog/part numbers. The Contractor shall make submittals on all the following equipment (in addition to any special items indicated elsewhere in the plans or specifications):
1. Lighting Fixtures
2. Wiring devices
3. Conduit
4. Wire
5. Panelboards
6. Switchgear
7. Fuses
8. Metering equipment
9. Transformers
10. Starters
11. Contactors
12. Disconnect switches

13. Lamps
14. Dimming systems
15. Special Systems equipment (Fire Alarm, Intrusion Alarm, Sound, TV, Lightning Protection, etc.).

B. Electrical System Controls: Refer to Section 016900 - Equipment Connections and Controls, for additional submittal requirements.

C. After receiving approval on the make and the type of materials, the Contractor shall order such materials in sufficient time to prevent any delay or changes on the job.

PART 3 - EXECUTION

3.1 GENERAL

A. Fabrication, erection and installation of the complete electrical system shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed, or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies the Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workmen.

3.2 EQUIPMENT

A. Equipment and materials furnished by the Contractor shall fit the spaces allocated for them. Should the equipment which the Contractor proposes to install, require space conditions other than indicated on the drawings, it shall be the Contractor's responsibility to reconcile the available space with the equipment and make any changes required to accommodate the equipment. All required changes shall be made at the Contractor's expense.

B. All equipment, both the Contractor and Owner furnished, shall be installed in accordance with the manufacturer's recommendations.

3.3 COORDINATION

A. The Electrical Plans are diagrammatic, but shall be followed as closely as actual construction and the work of other trades will allow. Such minor changes as are necessary to make the electrical work conform to the work of other trades and to the building shall be made without cost to the Owner.

3.4 CONDUITS

A. In all spaces such as ceiling spaces and equipment rooms, all conduits shall be run to a continuous grade and square to the building.

B. The plans do not give exact details as to the elevations of conduits, exact locations, etc., and do not show all off-sets, bends, junction boxes and other installation details. The Contractor shall carefully lay out their work at the site to conform to details of installation.

3.5 LOCATION OF EQUIPMENT AND OUTLETS

A. The approximate locations of cabinets, panelboards, wiring gutters, switches, light outlets, power outlets, etc., are indicated on the drawings; however, they are not intended to give complete and exact information. Determine the exact location after thoroughly examining the general building plans and by actual measurements during construction, subject to the approval of the Architect/Engineer.

B. Verify with Architect/Engineer, prior to installation, all locations of conduit, boxes, etc. stubbed or in the floor.

3.6 PROTECTION OF MATERIALS AND EQUIPMENT

A. The Contractor shall be responsible for the protection of all materials and equipment under this section of the work whether incorporated into the building or not.

B. The Contractor shall provide protection for all work where necessary and will be responsible for all damage done to property during the construction. The above protection shall be maintained while the work is in progress. In no case shall dirt, grit, etc. be ground into the floor finish or coverings.

C. The Contractor shall provide space for storage of materials and equipment at ground level.

3.7 CUTTING AND REPAIRING

A. Cutting and repairing shall be the responsibility of the Contractor. Coordinate to prevent unnecessary cutting and repairing. Lay out and locate equipment, openings, and chases. Install sleeves, inserts, and supports.

3.8 EXCAVATION AND BACKFILLING

A. The Contractor shall do all necessary excavation and backfill for the installation of the systems as may be required. Curb cuts, asphalt, and concrete patching, etc., shall be part of the Contractor's responsibility. Any required trenching will be done by hand and all existing utilities avoided. Damage done to existing utilities will be repaired by the Contractor with no additional payment for the work. In addition to the above, trenches shall be backfilled with dirt, free from debris, rocks, and other foreign matter. Backfill shall be replaced in the trenches in 6" layers and each 6" layer shall be wetted down adequately and properly tamped. Remove surplus dirt and leave premises clean. Perform excavation, backfilling and repaving required for work under this Division in accordance with DIVISION 2, SITE CONSTRUCTION. In general, backfill and tamp with compaction at least equal to that of the surrounding area.

3.9 WARRANTY

A. Deliver originals of all guarantees and warranties on this portion of the work to Owner. Warrant all equipment, materials, and workmanship for one year in accordance with the terms of this Contract.

3.10 PRODUCT HANDLING

A. Use all means necessary to protect electrical materials and equipment before, during and after installation and to protect the installed work of other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no extra cost to them.

END OF SECTION

SECTION 28 30 00 FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection, and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

C. The facility shall have an emergency voice alarm communication system. The digitized recorded voice message shall notify occupants that a fire condition has been reported. The message shall instruct the occupants with emergency instructions. Emergency manual voice override shall be provided.

D. The fire alarm manufacturer shall be of the highest caliber and insist on the highest quality. The system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001 ANSI/ASQC Q9001-1994.

E. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

F. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and shall be in compliance with the UL listing.

G. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

H. The system shall be an active/interrogative type system where each transponder is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the transponder and its associated initiating device and notification appliance circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.

I. The system shall be arranged such that not less than 20 percent additional transponders may be inserted into any network communication loop.

J. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.2 SCOPE

A. A new intelligent reporting, microprocessor controlled fire detection and emergency voice alarm communication system shall be installed in accordance with the specifications and drawings.

B. Existing fire detection equipment may be reused where the equipment
   1. Meets this specification section;
   2. Is approved by a recognized national agency (UL,FM, etc.);
   3. Is verified as compatible with new equipment being installed;
   4. Is verified as operable through testing and inspection;
   5. Is approved by the local Authority Having Jurisdiction (AHJ).

C. Basic Performance
   1. Alarm and trouble signals from each transponder shall be digitally encoded by listed electronic devices onto an NFPA Style 6 looped multiplex communication system.
   2. Alarm, trouble, and supervisory signals from all intelligent reporting devices shall be encoded onto NFPA Style 6 Signaling Line Circuits.
   3. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).
   4. Digitized electronic signals shall employ check digits or multiple polling.

5. Transponder devices are to consist of low current, solid-state integrated circuits, and shall be powered from local a primary power and standby battery power source.
6. Power for initiating devices and notification appliances must be from the main fire alarm control panel or the transponder to which they are connected.

7. A single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
8. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

9. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.
10. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
11. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Amplifiers shall be located in transponder cabinets to simplify installation and to reduce power losses in wiring.
12. Speaker circuits shall be 25 VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
13. Speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
14. Two-way telephone communication circuits shall be arranged so as to allow communication between the fire command center and up to seven (7) remote telephone locations simultaneously.
15. Means shall be provided to connect the telephone circuits to the speaker circuits to allow voice communication over the speaker circuit from a telephone handset.
16. A prerecorded voice module shall be used to store tones and/or messages and transmit them over speaker circuits automatically upon alarm actuation. The voice module shall be all-digital, with no moving parts.

D. Basic System Functional Operation
1. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur
   a. The System Alarm LED shall flash.
   b. A local piezo-electric signal in the control panel shall sound.
   c. The 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
   d. Printing and history storage equipment shall log the information associated with the fire alarm control panel condition, along with the time and date of occurrence.
   e. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

   f. The audio portion of the system shall sound the proper signal (tone or voice) to the appropriate zones.

E. The Contractor shall coordinate the requirements of interconnected systems including sprinkler systems, HVAC Fire/Smoke Damper Detectors and HVAC Duct Detectors. The contract drawings may not show all sprinkler waterflow and supervisory switch connections. All waterflow, supervisory switches, HVAC Fire/Smoke Damper Detectors and HVAC Duct Detectors shall be connected to the Fire Alarm System at no additional cost to the owner.

1.3 SUBMITTALS

A. General
1. All substitute equipment proposed as equal to the equipment specified herein, shall meet or exceed the following standards. For equipment other than that specified, the contractor shall supply proof that such substitute equipment does in fact equal or exceed the features, functions, performance, and quality of the specified equipment.
2. Quantity of copies of all submittals shall be submitted to the Architect/Engineer for review as called for in the architectural specifications.

B. Shop Drawings
1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Provide scaled reproducible shop drawings that include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts and wiring requirements. These drawings shall only contain information regarding the Fire Alarm System.
3. Show annunciator layout and main control panel module layout, configurations, and terminations.

C. Manuals
1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s) including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment and system.
4. Approvals will be based on complete submissions of manuals together with shop drawings.

D. Software Modifications
1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades, or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

E. Certifications Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.4 GUARANTY

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one-year period shall be included in the submittal bid.

1.5 POST CONTRACT MAINTENANCE

A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the submittal, include a quote for a maintenance contract to provide all maintenance, test, and repair described below. Include also a quote of unscheduled maintenance/repair, including hourly rates for technicians trained on this equipment and response travel costs. Submittals which do not identify all post contract maintenance costs will not be accepted. The rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Maintenance and testing shall be as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor which shall describe the plan for preventive maintenance of all devices and subassemblies requiring regular maintenance. The schedule shall include
1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, water flow switches and all accessories of the fire alarm system.
2. Each circuit in the fire alarm system shall be tested semiannually.
3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72, Chapter 7.

1.6 POST CONTRACT EXPANSIONS

A. The contractor shall provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

B. As part of the submittal include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

C. Quotation shall include installation and test labor and labor to reprogram the system for this 10% expansion. If additional loop interface hardware is required, include the material and labor necessary to install this hardware.

D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent, addressable device. Do not include cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.

E. Submittals which do not include this estimate of post contract expansion cost will not be accepted.

1.7 APPLICABLE PUBLICATIONS The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only.

A. National Fire Protection Association (NFPA) - USA
1. No. 70 National Electric Code (NEC)
2. No. 72-1993 National Fire Alarm Code
3. No. 101 Life Safety Code

B. Underwriters Laboratories Inc. (UL) - USA
1. No. 50 Cabinets and Boxes
2. No. 268 Smoke Detectors for Fire Protective Signaling Systems
3. No. 864 Control Units for Fire Protective Signaling Systems
4. No. 268A Smoke Detectors for Duct Applications.
5. No. 521 Heat Detectors for Fire Protective
6. No. 228 Door Closers-Holders for Fire Protective Signaling Systems.
7. No. 464 Audible Signaling Appliances.
8. No. 38 Manually Actuated Signaling Boxes.
9. No. 346 Waterflow Indicators for Fire Protective Signaling Systems.
10. No. 1481 Power supplies for Fire Protective Signaling Systems.
11. No. 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems.
12. No. 1971 Visual Notification Appliances.

C. Local and State Building Codes.

D. All requirements of the Authority Having Jurisdiction (AHJ).

1.8 APPROVALS

A. The system must have proper listing and/or approval from the following nationally recognized agencies
1. UL Underwriters Laboratories Inc.
2. FM Factory Mutual
3. ULC Underwriters Laboratories Canada
4. MEA Material Equipment Acceptance (NYC)
5. CSFM California State Fire Marshal

B. The Fire Alarm Control Panel and all transponders shall meet the modular labeling requirements of Underwriters Laboratories, Inc. Each subassembly, including all printed circuits, shall include the appropriate UL modular label. Systems which do not include modular labels may require return to the factory for system upgrades, and are not acceptable. Systems that do not include modular labels are not acceptable and may require return to the factory for upgrades.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL

A. All equipment and components shall be new, and the manufacturer’s current model. The materials, appliances, equipment, and devices shall be tested and listed by a nationally recognized approvals agency

for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.

C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE

A. Conduit
1. Conduit shall be in accordance with the National Electrical Code (NEC), local and state requirements.
2. Where possible, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
4. Wiring for 24-volt control, alarm notification, emergency communication, and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.
7. Class A conduit per NFPA 72.

B. Wire
1. All fire alarm system wiring must be new. Existing wiring shall not be reused. All existing wiring shall be removed.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.32 mm) for Notification Appliance circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the multiplex communication loop shall be twisted and shielded and installed in conduit unless specifically excepted by the fire alarm equipment manufacturer.
6. All field wiring shall be completely supervised.
7. All voice speaker and telephone circuits shall use twisted/shielded pair to eliminate crosstalk.

C. Terminal Boxes, Junction Boxes and Cabinets All boxes and cabinets shall be UL listed for their intended purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The main fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution Panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold-water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL [AND FIRE COMMAND CENTER]

A. The main FACP Central Console shall be a NOTIFIER Model AM2020 and shall contain a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of

equipment used to make up the system intelligent detectors, addressable modules, transponders, local and remote operator terminals, printers, annunciators, emergency voice communication systems and other system-controlled devices.

B. The main FACP [and Central Console] shall perform the following functions
   1. Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
   2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to transponders.
   3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
   4. Visually and audibly annunciate any trouble, supervisory or alarm, condition on operator's terminal, panel display, and annunciators.

C. System Capacity and General Operation
   1. The control panel shall provide, or be capable of expansion to, 198 intelligent/addressable devices per loop plus 2048 annunciation points per system.
   2. The fire alarm control panel shall include a full featured operator interface control and annunciation panel which shall include a Bake lite Liquid Crystal Display (LCD), individual, color coded system status LEDs, and an alpha-numeric keypad for field programming and control of the fire alarm system.
   3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.
   4. The system shall include emergency voice communications utilizing distributed amplification and intelligence such that loss of operation by the main FACP will not result in the loss of evacuation signal throughout the balance of the building.
   5. The FACP shall provide the following features

a. Block Acknowledge	Printer Interface
b. Charger rate Control	CRT Display Interface
c. Control-by-Time	Non-Alarm Module Reporting
d. Day/Night Sensitivity	Periodic Detector Test
e. Device Blink Control	Remote Page
f. Drift Compensation	Trouble Reminder
g. NFPA 72, Sensitivity Test	Upload/Download to PC computer
h. System Status Reports	Verification Counters
i. Security Monitor Points	Walk Test
j. Alarm Verification	Maintenance Alert

D. Central Processing Unit (CPU)
   1. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection, or failure of any control panel module shall be detected and reported to the system display by the central processing unit.
   2. The CPU shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
   3. The Central Processing Unit shall also provide a real-time clock for time annotation of all system displays. The Time-Of-Day and date shall not be lost if system primary and secondary power supplies fail.

E. Display
   1. The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
   2. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
   3. The system display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 light-emitting-diodes (LEDs), which will indicate the status of the following system parameters AC POWER, SYSTEM ALARM; SYSTEM TROUBLE, DISPLAY TROUBLE, and SIGNAL SILENCE.
   4. The system display shall provide a 25-key touch keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels will be accessible through the display interface assembly to prevent unauthorized system control or programming.
   5. The system display shall include the following operator control switches SIGNAL SILENCE, LAMP TEST, RESET, SYSTEM TEST, and ACKNOWLEDGE

F. Loop Interface Board (LIB)
   1. Loop Interface Boards shall be provided to monitor and control each of the Signaling Line Circuit (SLC) Loops in the system. The loop interface board shall contain its own microprocessor and shall be capable of operating in local mode in the case of a failure in the main CPU of the control panel. In local mode, the loop interface board shall detect alarms and activate output devices on its own SLC loop.
   2. The LIB shall not require any jumper cuts or address switch settings to initialize SLC Loop operations.
   3. The Loop Interface Board shall provide power to, and communicate with, all of the intelligent detectors and addressable Modules connected to its SLC Loop over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 7.
   4. The LIB shall be able to drive two Style 7 runs of these SLC Loops, each up to 10,000 feet in length.
   5. The Loop Interface Board shall receive analog information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The loop interface board software shall include software to automatically adjust and compensate for dust accumulation to maintain detector performance as it is affected by environmental factors. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
   6. The LIB shall communicate with each Intelligent Addressable Detector and addressable module on its SLC loop and verify proper device function and status. Communication with up to 198 intelligent devices shall be performed every 6 seconds or less.

G. Serial Interface Board (SIB)
   1. The Serial Interface Board shall provide the EIA-232 interface between the fire alarm control panel and UL-Listed Electronic Data Processing (EDP) peripherals.
   2. The SIB shall allow the use of multiple printers, CRT monitors, and other peripherals connected to the EIA-232 ports.
   3. The Serial Interface Board shall provide one EIA-485 port for the serial connection of the optional annunciator and control subsystem components.
   4. The SIB shall include LEDs which indicate that it is in regular communication with the annunciators and other EIA-485 connected peripheral devices.
   5. All EIA-232 circuits shall be optically isolated and power limited.

H. Enclosures
   1. The control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
   2. The back box and door shall be constructed of .060 steel with provisions for electrical conduit connections into the sides and top.
   3. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
   4. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

I. The main FACP central console shall be designed so as to permit continued local operation of remote transponders under both normal and abnormal network communication loop conditions. This shall be obtained by having transponders operate as local control panels upon loss of network communication.

J. The FACP and CPU shall be modular in construction to allow ease of servicing. The CPU and transponders shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems which require use of external programmers or change of EPROMs are not acceptable.

K. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients including RFI and EMI.

L. Each transponder and peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU, transponders, and peripheral devices shall be reliable and error free. The transmission scheme used should employ dual transmission or other equivalent error checking techniques. Failure of any transponder or peripheral device to respond to an interrogation shall be annunciated as a trouble condition.

M. Voice Command Center (VCC)
   1. The Voice Command Center (VCC), located with the FACP, shall contain all equipment required for all audio control, telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control telephone circuit indication and control, digital voice units, microphone, and main telephone handset.
      a. Function. The Voice Command Center equipment shall perform the following functions:

1) Operate as a supervised single channel emergency voice communication system.
2) Operate as a two-way emergency telephone system control center.
3) Audibly and visually annunciate the active or trouble condition of every speaker circuit and telephone circuit.
4) Audibly and visually annunciate any trouble condition of tone generators and digital voice units required for normal operation of the system.
5) Provide all-call activities through activation of a single control switch.
6) Provide automatic, digitally-recorded voice messages and tones which may be field-programmed through the microphone.

b. The VCC shall be modular in construction. The VCC shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment. Equipment shall be an integral part of the FACP. Stand alone voice evacuation panels will not be accepted.

c. The VCC and associated equipment shall be protected against unusually high voltage surges or line transients.

N. Power Supply

1. The main power supply shall operate on 120 VAC, 60Hz, and shall provide all necessary power for the FACP.
2. It shall provide 3.0 amps of usable notification appliance power, using a switching 24 VDC regulator.
3. It shall be expandable for additional notification appliance power in 3.0 ampere steps.
4. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. It shall charge 55 Amp Hour batteries with-in a 48-hour period.
5. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.
6. It shall be power-limited per 1995 UL864 requirements.
7. It shall provide meters to indicate battery voltage and charging current.

O. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The connection between the UDACT and the control panel shall be completely supervised.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA requirements. It shall include the ability for split reporting of panel events.
3. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
4. The UDACT shall be capable of transmitting events in at least 9 different formats. This ensures compatibility with existing and future transmission formats. Accepted formats include
   a. 3+1 Standard - 4+1 Standard
   b. Ademco Contact ID - 4+1 and 4+2 Ademco
5. Communication shall include vital system status such as
   a. Independent Zone (Alarm, trouble, non-alarm)
   b. Independent Zone Supervisory Signal
   c. AC (Mains) Power Loss
   d. Low Battery and Earth Fault
   e. System Off Normal
   f. 12 and 24 Hour Test Signal
   g. Abnormal Test Signal (per UL requirements)
   h. EIA-485 Communications Failure
6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

P. Field Charging Power Supply the FCPS is a device designed for use as either a remote 24-volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 7.0-amp hour batteries and to support 60 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Z or Y) shall be available for connection to the Notification devices.
3. The FCPS shall include an attractive surface mount backbox.
4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per 1993 NFPA requirements.
5. The FCPS include power limited circuitry, per 1995 UL standards.

Q. System Circuit Supervision
1. The FACP shall supervise all circuits to intelligent devices, transponders, annunciators and peripheral equipment and annunciate loss of communications with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information on the printer.
2. Transponders that lose communication with the CPU shall sound an audible trouble and light an LED indicating loss of communications.
3. Transponder Circuit Supervision Transponders shall be designed such that they continuously scan all of their initiating and notification circuits. With normal communications between the FACP and the transponders, the transponders shall transmit initiating and notification circuit trouble conditions to the FACP for audible annunciation and printout. With or without communication with the FACP, the transponders shall supervise their circuits and annunciate any initiating circuit and notification circuit failures on LEDs located on the transponder.
4. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.
5. All speaker and emergency phone circuits shall be supervised for opens and shorts. Each transponder speaker and emergency phone circuit shall have an individual ON/OFF indication (green LED).

R. Field Wiring Terminal Blocks: For ease of service, all wiring terminal blocks shall be the plug-in type and have sufficient capacity for 18 to 12 AWG wire. Fixed terminal blocks are not acceptable.

S. Audio Amplifiers
1. The Audio Amplifiers will provide Audio Power (@25 Volts RMS) for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in the transponder or in the main fire alarm control panel, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide the following controls and indicators
   a. Normal Audio Level LED
   b. Incorrect Audio Level LED
   c. Brownout LED
   d. Battery Trouble LED
   e. Amplifier Trouble LED
   f. Audio Amplifier Gain Adjust
4. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
5. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
6. Amplifier shall be backed up in groups (1 amplifier backs up several). Failure of any one amplifier in the system shall not degrade system performance in any way.

T. Audio Message Generator (Prerecorded Voice)/Speaker Control
1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. The message generator shall provide a system paging capability from telephone circuits.
5. The audio message generator shall have the following controls and indicators to allow for proper operator understanding and control

   All Call LED
   On-Line LED
   All Call Switch
   Local Speaker Volume Control
   Local (Test) Speaker

6. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
7. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

U. Emergency Two-Way Telephone Control Switches/Indicators
1. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.

2. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

V. Operators Terminal: Provide the following functions in addition to any other functions required for the system.
1. Acknowledge (ACK/STEP) Switch
   a. Activation of the control panel Acknowledge switch in response to a single new Alarm and/or trouble condition shall silence the local panel piezo electric signal and change the system alarm or trouble LED from flashing mode to steady-ON mode. If additional new Alarm or Trouble conditions exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
   b. Depressing the acknowledge switch shall also silence all remote annunciator piezo sounders.
2. Signal Silence Switch
   a. Activation of the signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm activation. The selection of notification circuits and relays which are silenceable by this switch shall be fully field programmable within the confines of all applicable standards.
3. System Reset Switch
   a. Activation of the system reset switch shall cause all electronically latched initiating devices, appliances, or software zones, as well as all associated output devices and circuits, to return to their normal condition.
   b. If an alarm condition(s) still exists, or if they reoccur in the system after system reset switch activation, the system shall then resound the alarm conditions.
4. System Test Switch.
   a. Activation of the system test switch shall initiate an automatic test of all Intelligent/Addressable detectors in the system. The system test shall activate the electronics in each intelligent sensor, simulating an alarm condition and causing the transmission of the alarm condition from that sensor to the fire alarm control panel. The fire alarm control panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the system LCD, and on any CRTs or printers in the system.
5. Lamp Test Switch
   a. Activation of the lamp test switch shall sequentially turn on all LED indicators, system liquid crystal display and local piezo signal, and then automatically return the fire alarm control panel to the previous condition.

W. Video Display Terminal
1. The Video Display Terminal shall provide a visual display and an audible alert of all changes in status of the system and shall annotate such displays with the current time-of-day and date.
2. The Video Display Terminal shall be enclosed in a cabinet suitable for placement on a desktop or table.
3. A detachable keyboard shall be provided that may be used for programming, testing, and control of the system. Individual keys shall be provided on the keyboard for the ACKNOWLEDGE, RESET, LAMP TEST, SYSTEM TEST, and SIGNAL SILENCE functions of the control panel.
4. The video display terminal shall include a count of all alarms and troubles in the system, as well as a count of all alarms and trouble requiring acknowledgment. These counts shall be continuously displayed during all FACP operations.
5. The video display terminal shall meet Swedish magnetic emission and X-radiation guidelines MPR 199010.

X. Printer
1. Printers shall be of the automatic type, printing code, time, date, location, category, and condition.
2. The printer shall provide hard-copy printout of all changes in status of the system and shall timestamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control using an interface complying with Electrical Industries Association standard EIA-232D. The printer power shall be 120 VAC @ 60 Hz.
3. Thermal printers are not acceptable.
4. The system shall have an optional strip printer capable of being mounted directly in the system enclosure. Alarms shall be printed in easy to read RED, other messages, such as troubles, shall be printed in black. This printer shall receive power from the system power supply and shall operate via battery back-up in the unlikely event that AC mains are lost. The strip printer shall be UL-864 listed.

Y. Transponders (Remotely Located Control Panels)
1. Transponders shall be listed under UL category UOJZ as an independent, local fire alarm control unit as well as being listed as a critical component in a multiplex fire alarm system. Transponders shall be located where shown on the plans.

a. The transponder shall serve as the interface between initiating fire devices, controlled signaling devices, and the CPU. The supervised multiplex communication port shall be an integral part of the transponder.

2. Each Transponder shall be powered from a local Power Supply, and shall provide all power necessary for its own operation, including standby power.
3. Transponders shall communicate with, and be controlled by, the host Fire Alarm Control Panel via a 2-wire SLC Loop. This SLC Loop shall operate as a NFPA Style 4, Style 6 or a Style 7 Loop.
4. Transponders shall be used to house amplifiers, batteries, and power supplies to allow a true distributed processing and amplification.
5. Each transponder shall have the following indicators and operator Controls
   a. Alarm Acknowledge/Reset Switch
   b. Power LED
   c. System alarm LED
   d. System trouble LED
   e. Local piezoelectric signal
   f. Red alarm per Initiating Device Circuit
   g. Green on/off LED per notification appliance circuit or relay
6. Each transponder will be capable of expansion of up to 24 field circuits of the following types in any mix

Z. Initiating Device Circuits (IDC) IDCs may be added to the Transponder in groups of 8 Style B (Class B), or 4 Style D (Class A) circuits. Each circuit shall be capable of monitoring up to 30 compatible 2-wire smoke detectors, and/or any number of contact type initiating devices.

AA. Fire Fighter's Telephone Circuits Firefighter's telephone circuits may be added to the transponder in groups of 8 circuits.

BB. Fire alarm speaker circuits Fire alarm speaker circuits may be added to the transponder in groups of 8 circuits. Each circuit shall be capable of supervising the field circuit, and of transmitting up to 30 Watts of audio power.

CC. Auxiliary Control Relay Outputs Auxiliary relay outputs may be added to the transponder in groups of eight individually controlled single Form-C circuits, or four dual Form-C circuits. All Auxiliary circuits shall be rated 2 A. @ 30 VDC.

DD. Field Programming
1. The system shall be programmable, configurable, and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
2. All programming shall be accomplished through the standard FACP keyboard or through the video display terminal.
3. All field defined programs shall be stored in non-volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.

EE. Specific System Operations
1. Smoke Detector Sensitivity Adjust Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.
2. Alarm Verification Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. System Point Operations
   a. Any device in the system may be enabled or disabled through the system keypad or video terminal.
   b. Any system output point may be turned on, or off, from the system keypad or the video terminal.
4. Point Read The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point will be annunciated for the parameters listed
   a. Device Status.
   b. Device Type.
   c. Custom Device Label.
   d. Software Zone Label.
   e. Device Zone Assignments.
   f. Detector Analog Value.
   g. All Program Parameters.

5. System Status Reports Upon command from a password-authorized operator of the system, a status report will be generated, and printed, listing all system status.
6. System History Recording and Reporting The fire alarm control panel shall contain a History Buffer that shall be capable of storing up to 400 system output/input/control activations. Each activation will be stored, and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the History Buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and or printed.
7. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
8. Automatic Detector Maintenance Alert The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
9. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

2.4 SYSTEM COMPONENTS

A. Speakers
1. Shall operate on 25 VRMS with field selectable output taps from 0.5 to 2.0 W.
2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
3. Frequency response shall be a minimum of 400 Hz to 4000 Hz.

B. Strobe Lights shall be combination strobe-mini sounder units.
1. Shall operate on 24 VDC nominal.
2. Shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria
   a. The maximum pulse per UL 1971.
   b. Candela intensity shall meet the requirements of UL 1971.
   c. The flash rate shall meet the requirements of UL 1971.
   d. The appliance shall be placed 80 in (2,030 mm) above the highest floor level within the space, or 6 in (152 mm) below the ceiling, whichever is lower.
   e. Where two or more strobes may be viewed those strobes shall be synchronized.
   f. The design intent with the strobe and strobe/horn units is to meet ADA and NFPA requirements regarding unit candela rating. The contractor shall provide the corresponding strobe in the respective areas. The intent of this requirement is to minimize power supplies. Contractor shall show these candela ratings on shop drawings.

C. Audible/Visual Combination Devices
1. Shall meet the applicable requirements of Section A listed above for audibility.
2. Shall meet the requirements of Section B listed above for visibility.

D. Addressable Devices - General
1. Addressable devices shall provide an address-setting means using rotary decimal switches.
2. Addressable devices shall use simple to install and maintain decade (numbered 1 to 10) type address switches. Devices which use a binary address setting method, such as a dip switch, which are difficult to install and subject to installation error. This type of device is not an allowable substitute.
3. Detectors shall be Intelligent and Addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual (2) alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. Smoke detector sensitivity shall be set through the Fire Alarm Control Panel and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.

7. The detectors shall be ceiling-mount and shall include a separate twist-lock base which includes a tamper proof feature. An optional base shall be available with a built-in (local) sounder rated at 85 DBA minimum.
8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

E. Addressable Pull Box (manual station)
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall be double-action and shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be double action and constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.
4. Stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

F. Intelligent Photoelectric Smoke Detector
1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

G. Intelligent Ionization Smoke Detector
1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

H. Intelligent Thermal Detectors
1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit. Up to 99 intelligent heat detectors may connect to one SLC loop.

I. Intelligent Duct Smoke Detector
1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

3. Fire alarm addressable duct detectors and fire alarm addressable relays for fan shutdown shown on the HVAC equipment will be addressed as follows:
   a. Duct detectors shall be provided by the division 16 contractor and installed by the division 15 contractor. Fan shutdown relay shall be provided and installed by the division 16 contractor. Division 15 controls contractor shall connect the relay for fan shutdown. The division 16 special systems contractor shall monitor both devices.

J. Addressable Dry Contact Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a 4-inch square, 2-1/8-inch-deep electrical box.
3. The IDC zone may be wired for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4-inch x 1-1/4-inch x 1/2 inch. This version need not include Style D or an LED.

K. Two Wire Detector Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).

2. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.
3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

L. Addressable Control Module
1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of .6 amps at 30 VDC.

M. Isolator Module
1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

N. LCD Alphanumeric Display Annunciator
1. The alphanumeric display annunciator shall be a supervised, locally or remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. Up to 32 LCD annunciators may be connected to a specific (terminal mode) EIA 485 interface. LCD annunciators shall not reduce the annunciation capacity of the system. Each LCD shall include vital system wide functions such as, System Acknowledge, Silence and Reset.
4. LCD display annunciators shall mimic the main control panel 80-character display and shall not require special programming.

O. Portable Emergency Telephone Handset Jack
1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on plans. Handset jacks shall be approved for emergency telephone system application.
2. Insertion of a remote handset plug into a jack shall send a signal to the fire command center which shall audibly and visually indicate the on-line condition, and shall sound a ring indication in the handset.
3. The two-way emergency telephone system shall support a minimum of seven (7) handsets online without degradation of the signal.

P. Fixed Emergency Telephone Handset
1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. The two-way emergency telephone system shall support a maximum of seven (7) handsets online (off hook) without degradation of the signal.

2.5 BATTERIES AND EXTERNAL CHARGER

A. Battery
1. Shall be 12 volt, Gel-Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

B. External Battery Charger
1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt 60 hertz source.
2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, NFPA72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3.2 TYPICAL OPERATION

A. Actuation of any manual station, smoke detector, heat detector or water flow switch shall cause the following operations to occur unless otherwise specified
1. Activate all programmed speaker circuits.
2. Actuate strobe units until the panel is reset.
3. Light the associated indicators corresponding to active speaker circuits.
4. Release all magnetic door holders to doors to adjacent zones on the floor from which the alarm was initiated.
5. Return all elevators to the primary or alternate floor of egress.
6. A smoke detector in any elevator lobby shall, in addition to the above functions, return all elevators to the primary or alternate floor of egress.
7. Smoke detectors in the elevator machine room or top of hoistway shall return all elevators in to the primary or alternate floor. Smoke detectors or heat detectors installed to shut down elevator power shall do so in accordance with ANSI A17.1 requirements and be coordinated with the electrical contractor.
8. Duct type smoke detectors shall, in addition to the above functions, shut down the ventilation system or close associated control dampers as appropriate.
9. Activation of any sprinkler system low pressure switch, on valve tamper switch, shall cause a system supervisory alarm indication.

B. Auxiliary Control System Normal Operation
1. "On/Auto/Off" switches and status indicators shall be provided for monitoring and manual control of fans, dampers, door unlocking, door holder release, HVAC Control Units, Elevator Status, Stairwell Pressurization or Smoke Exhaust Fans.
2. Manual "Off" indication shall be red. "On" indication shall be green. In all modes, the "on" and "off" indications shall continuously follow the device status. Manual selection of "on" shall force the controlled relay to the "on" state until manually returned to "automatic" state. Manual selection of "off" shall force the controlled relay to the "off" state until manually returned to "automatic." All HVAC system controls (i.e., limit switches, vane switches, etc.) to be provided by the HVAC contractor.
3. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. A single yellow trouble LED shall be provided with each switch to indicate a trouble in the monitor and control point(s) associated with that switch.

3.3 TEST

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
   3. Verify activation of all flow switches.
   4. Open initiating device circuits and verify that the trouble signal actuates.
   5. Open signaling line circuits and verify that the trouble signal actuates.
   6. Open and short notification appliance circuits and verify that trouble signal actuates.
   7. Ground initiating device circuits and verify response of trouble signals.
   8. Ground signaling line circuits and verify response of trouble signals.
   9. Ground notification appliance circuits and verify response of trouble signals.
   10. Check alert tone and prerecorded voice message to all alarm notification devices.
   11. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.
   12. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
   13. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.4 FINAL INSPECTION

A. At the final inspection, a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.5 INSTRUCTION

A. Provide instruction as required for operating the system. "Hands-on" demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer’s representatives shall provide a typewritten "Sequence of Operation" to the Owner.

END OF SECTION

SECTION 31 2303

BUILDING PAD PREPARATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. The section applies to earth-supported building pads and other paving indicated on the drawings to receive “Building Pad Preparation”.
2. The section includes materials, labor and equipment required for complete installation of building pad including but not limited to: excavation, scarification and re-compaction of soils, moisturizing of soil, engineered fill material, lime and water injection, backfilling and compaction of soil, and installation of vapor retarder under slabs.
3. Testing for moisture content of soils, plasticity index of engineered fill, and compaction.

B. Section excludes – see other sections for:

1. Clearing and grubbing of site
2. Mass excavation and rough grading
3. Final grading of site
4. Backfill around grade beams and basement walls
5. Laboratory testing and inspection

1.2 REFERENCES

A. American Society for Testing and Materials:

1. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
5. ASTM D 2488 - Standard Practice of Description and Identification of Soils (Visual-Manual Procedure).
6. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Method (Shallow Depth).
7. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
8. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. Texas Department of Transportation: TxDOT - 2004 Standard Specifications for Construction of Highways, Streets and Bridges.

1.3 SYSTEM DESCRIPTION

A. Building pad preparation shall be as described in the Project Geotechnical Report, utilizing the following method(s):

1. Engineered Fill

a. Excavate existing soils to provide minimum depth of engineered fill material
b. Place engineered fill in thin lifts and compact

2. Removal and Replacement of Soil

a. Remove all existing clay soils to top of rock

b. Fill to bottom of slab elevation with engineered fill material
c. Place engineered fill in thin lifts and compact

3. Reconditioning of Existing Soil

a. Excavation existing soil to required depth and stockpile on site
b. Add moisture to soil, replace in thin lifts and compact

4. Scarification and Compaction

a. Scarify in-situ soil to required depth
b. Add lime to soil
c. Compact soil in place

5. Water Injection

a. Pressure-inject water to required depth
b. Make multiple passes of water injection until required moisture content is achieved

6. Lime and Water Injection

a. Pressure-inject mixture of lime and water to required depth
b. Make additional passes of water (only) injection until required moisture content is achieved

B. Recommendations and specifications of the Project Geotechnical Report are based on soil borings taken at discreet locations. No representation is made or implied regarding continuity of conditions between borings. Additional soil borings may be made at Contractor's expense and option to verify subsoil conditions.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Contractor performing building-pad preparation work shall have at least three years' collective experience with the specific method of preparation required, and under similar circumstances.
2. Upon request, demonstrate to the satisfaction of the Architect the dependability of the systems, materials and techniques to be used by experience, example or test.

B. Pre-construction Conference

1. Contractor shall arrange a conference to include the Architect, Engineer, Owner and Owner's Testing Laboratory, and all sub-contractors involved in the installation of building pads before construction to demonstrate the suitability of the system and equipment.

1.5 PROJECT AND SITE CONDITIONS

A. Existing conditions: Contractor is responsible for locating and protecting existing underground utilities and building foundations.

B. Contractor shall inspect the site for conditions that may adversely affect installation of required building pads and report to the Architect before commencing work.

C. Contractor shall be thoroughly familiar with the Project Geotechnical Report.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate installation of building pads with excavation, installation and removal of utilities and other site-related activities.

1.7 SUBMITTALS

A. Product data

1. Submit manufacturers' descriptive literature, specifications and installation instructions for each manufactured product.

B. Samples

1. Submit samples of fill materials in sufficient quantity for laboratory testing

C. Testing and Inspection reports

1. Submit copies of required laboratory reports for compaction, moisture content, and soil characteristics.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. See the Project Geotechnical Report for required characteristics of engineered fill materials.

2.2 MANUFACTURED PRODUCTS

A. Vapor Retarder

1. Sheet Vapor Retarder: Shall conform to ASTM E 1745, Class C or better and shall have a minimum water vapor permeance of 0.034 perms when tested in accordance with ASTM E 96.

a. Acceptable Products:

1) Griffolyn Type-65 by Reef Industries, Inc., P.O. Box 750250, Houston, TX 77275, 713.943.0070.
2) 10 Mil Stego Wrap by Stego Industries, 28012 Paseo Reposo, San Jaun Capistrano, CA. 92675, 877.464.7834.
3) 10 Mil VAPOR-MAT by W.R. Meadows, P.O. Box 338, Hampshire, IL. 60140-0338, 847.214.2100

2. Adhesive: Compatible with sheet vapor retarder, permanently non-curing
3. Tape: Double-sided asphaltic pressure sensitive mastic, 4" wide; compatible with sheet vapor retarder

B. Hydrated Lime – see Project Geotechnical Report for requirements

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify and identify required lines, levels, contours and benchmark elevations.

B. Locate and identify underground utilities.

C. Notify Architect of unexpected subsurface conditions.

D. Verify that excavations are in proper condition before placing fill material.

3.2 PREPARATION

A. Protection:

1. Protect benchmarks and existing structures to remain from excavation equipment and vehicular traffic.
2. Protect plant life, lawns, rock outcroppings, and other features remaining as a portion of final landscaping.
3. Protect excavations from rain and from drying out when construction has been delayed, cave-ins or loose soil from falling into excavations, and from freezing.
4. Provide barricades, warning signs, lights, and other items at open excavations to comply with governmental regulations.
5. Maintain and protect above and below grade utilities to remain.

B. Surface Preparation:

1. Notify utility companies to remove and relocate existing utilities.
2. Correct irregularities in substrate gradient and elevation by scarifying, reshaping and re-compacting.
3. Compact excavation surface material to density requirement for backfill materials.

4. Where required by the Geotechnical Report, scarify and re-compact the excavation surface.

3.3 EARTHWORK

A. Excavation

1. Excavate to required subgrade elevation.

a. Where required by the Geotechnical Report, remove soil to top of underlying rock.

2. Excavations shall not infringe on stress cones under existing foundations extending along a 45-degree line from the bottom of any footing.

B. Stockpiling

1. Stockpile excavated material on site for use as general site fill.

a. Do not pile soil within the drip line of trees to remain.
b. Locate and retain stockpile away from the edges of excavations.
c. Protect stockpile from erosion.
d. Dispose of excess excavated materials and materials not suitable for reuse off site premises.

C. Excavation stability

1. Slope sides of excavation to comply with governmental regulations.

a. Maintain sides and slopes of excavation in safe condition.

2. Provide shoring and bracing where sloping is not possible or suitable.

D. Proof Rolling

1. Where required by the Geotechnical Report, proof roll site or excavated subgrade using a pneumatic-tired roller weighing approximately 25 tons.

E. Backfilling

1. Before backfilling, check and prepare subgrade:

a. Remove ice, snow or standing water
b. Remove debris and trash
c. Verify proper subgrade elevation(s)
d. Scarify and re-compact soft spots and loose surface materials
e. Remove rocks, boulders and loose soil
f. Scarify and re-compact, or proof-roll excavation subgrade where required by the Geotechnical Report.

2. Backfill under slabs with required materials to subslab elevation.

a. Backfill in thin lifts, moisturize and compact material as required by the Geotechnical Report.
b. Do not attempt to place backfill during rain, snow, or sleet.
c. Do not place fill material on frozen ground.

F. Moisture control and protection

1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to required density.
2. Protect and maintain moisture content of subgrade until placement of slabs.

a. Use asphalt seal coat where recommended by the Geotechnical Report

3. Where required, protect the surface of existing soil from drying prior to placement of slabs, by one of the following methods,

a. Maintain and repair existing pavement

b. Use asphalt seal coat
c. Install a protective layer of select fill material (12 to 18 inches thick).

3.4 MOISTURE INJECTION

A. Inject water into existing subgrade to required depth using approved equipment capable of forcing water into the soil at the required depth.

1. Where required, the first pass of injection shall use a mixture of lime and water, and a surfactant. See the Geotechnical Report.

B. After each injection pass, measure water content of the soil at depths and intervals recommended in the Geotechnical Report and compare with required criterion.

C. Offset each injection pass so that injection tubes penetrate into un-disturbed soil.

D. Continue injection process until required moisture content is achieved, or the owner instructs otherwise.

3.5 INSTALLATION OF VAPOR RETARDER

A. General

1. Lay vapor retarder with longer dimension parallel with the direction of concrete placement.
2. Lap joints at edges at least 6 inches
3. Wrap free edges entirely across beam trenches, or secure to perimeter beams with mastic and pressure-sensitive tape.
4. Leave edges exposed a sufficient lap distance at construction joints and bulkheads.

B. Sealing

1. Seal joints with manufacturer’s recommended mastic and pressure-sensitive tape.
2. Seal penetrations with manufacturer’s recommended mastic and pressure-sensitive tape.
3. Repair punctures and tears.

3.6 FIELD QUALITY CONTROL

A. Inspection Services: an independent testing agency shall perform the following inspection services:

1. Inspect stockpiles of excavated material for reuse
2. Inspect engineered backfill material for suitability
3. Observe backfilling and compacting procedures
4. Observe pressure injection process
5. Observe proof rolling process
6. Inspect condition of subgrade before commencing backfill

B. Laboratory Testing

1. Test each lift of backfill for moisture content and compaction before subsequent lifts are placed.

a. Perform field density tests in accordance with ASTM D698, D3017, D2922 or D4318
b. Perform one density test for each 3,000 square feet of surface area, or at least 2 tests per unit of work.
c. Perform additional tests until required density and moisture content are achieved.

2. Test soil for moisture content after each pass of water or water and lime injection.
3. Test engineered fill material for soil characteristics (moisture content, plasticity index).
4. Determine subgrade modulus, where required.

END OF SECTION

SECTION 310513.1

SOILS FOR EARTHWORK (RETAINING WALL)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Subsoil materials.
2. Topsoil materials.

1.2 SUBMITTALS

A. Samples: To be submitted to testing agency per the contract documents.

B. Materials Source: Name of imported materials source.

C. Manufacturer's Certificate: Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout Work.

B. Perform Work according to applicable codes and contract documents.

PART 2 PRODUCTS

2.1 TOPSOIL MATERIALS
1. Conforming to contract documents.

2.2 SOURCE QUALITY CONTROL

A. Testing and Analysis of Subsoil Material: Perform according to Contract Documents.

B. Testing and Analysis of Topsoil Material: Perform according to Contract Documents.

C. When tests indicate materials do not meet specified requirements, change material and retest.

D. Furnish materials of each type from same source throughout Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials, subsoil and topsoil not intended for reuse, from Site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from Site.

3.2 STOCKPILING

A. Stockpile materials on Site at locations designated by Architect/Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile topsoil 8 feet high, maximum.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

G. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade Site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade Site surface to prevent free standing surface water.

END OF SECTION

SECTION 312316.1
EXCAVATION (RETAINING WALL)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil densification.
   2. Excavating for Site structures.
   3. Excavating for landscaping.

1.2 SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

B. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.

1.3 QUALITY ASSURANCE

A. Perform Work according to contract documents and applicable codes.

B. Prepare excavation protection plan under direct supervision of professional engineer experienced in design of this Work and licensed in State of Texas.

PART 2 EXECUTION

2.1 PREPARATION

A. Call local utility line information service not less than three working days before performing Work.
   1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, rock outcroppings, and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

2.2 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation Work.

B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving, and Site structures, and construction operations.

C. Excavate to working elevation for piling Work.

D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction according to Section 31 23 23 and Section 31 23 17.

E. Slope banks with machine to angle of repose or less until shored.

F. Do not interfere with 45-degree bearing splay of foundations.

G. Grade top perimeter of excavation to prevent surface water from draining into excavation.

H. Trim excavation. Remove loose matter.

I. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume. Remove larger material as specified in Section 31 23 23.

J. Notify Architect/Engineer of unexpected subsurface conditions.

K. Correct areas over excavated with as directed by Architect/Engineer.

L. Remove excess and unsuitable material from Site.

M. Repair or replace items indicated to remain damaged by excavation.

2.3 FIELD QUALITY CONTROL

A. Request inspection of excavation and controlled fill operations according to applicable code.

B. Request visual inspection of bearing surfaces by inspection agency before installing subsequent Work.

2.4 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 312323.1

FILL (RETAINING WALL)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Backfilling building perimeter to subgrade elevations.
2. Backfilling Site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Fill under paving.
5. Fill for over-excavation.

1.2 SUBMITTALS

A. Product Data: Geotextile fabric indicating fabric and construction.

B. Samples: Submit to testing agency per contract documents.

C. Materials Source: Submit name of imported fill materials suppliers.

D. Manufacturer's Certificate: Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Perform Work according to applicable codes and contract documents.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Provide per contract documents.

B. Structural Fill: Provide per contract documents.

C. Granular Fill: Provide per contract documents.

D. Concrete:
1. Lean concrete.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

B. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

C. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface per contract documents.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Place geotextile fabric per contract documents.

D. Place fill material in continuous layers and compact according to contract documents.

E. Employ placement method that does not disturb or damage other Work.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Backfill against supported foundation walls. Do not backfill against unsupported foundation walls..

H. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

I. Slope grade away from building per contract documents.

J. Make gradual grade changes. Blend slope into level areas.

K. Remove surplus backfill materials from Site.

L. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Top Surface of Backfilling per contract documents.

B. Top Surface of Backfilling per contract documents

C. Top Surface of General Backfilling: Per contract documents.

3.5 FIELD QUALITY CONTROL

A. Perform laboratory material tests according to contract documents.

B. Perform in place compaction tests according to following:
   1. Density Tests: Per contract documents.
   2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Frequency of Tests: Per contract documents.

E. Proof roll compacted fill surfaces under slabs-on-grade, pavers, and paving.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 32 17 26 – TACTILE WARNING SURFACING DETECTABLE WARNING SURFACE PANELS CAST-IN-PLACE REPLACEABLE

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes Specifications for furnishing and installing embedded Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) with an in-line truncated dome pattern embedded in concrete at pedestrian crossings, boarding platforms, and rail crossing locations to the dimensions shown on the Drawings, in accordance with the Contract Documents and as directed by the Engineer.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specifications Section, apply to this Section.

B. Department of Justice ADA Standards (2010)

C. Department of Transportation ADA Standards for Transportation Facilities (2006)

D. Proposed Guidelines for Accessible Public Rights-of-Way (2011)

E. California Title 24

F. ISO 23599:2019-01 – Assistive products for blind and vision-impaired persons — Tactile walking surface indicators

G. ISO 21542:2011 – Building Construction – Accessibility and Usability of the Built Environment

H. ISO 9001 – Certificate No. 0502011, ISO 1409 and ISO/B 16949 Certified Manufacturing Facility located in Jefferson, Ohio

I. Accessibility for Ontarians with Disabilities Act - (AODA)

J. Canadian Standards Association – (CSA)

1.3 SUBMITTALS

A. Product Data Sheet: Submit ADA Solutions literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two (2) detectable warning surface panel samples. Samples shall be properly labeled and shall contain the following information: Name of Project, Submitted By, Date of Submittal, and Manufacturer’s Name.

C. Shop Drawings: Submit the Standard Manufacturer Shop Drawings showing all pertinent characteristics of the Cast- In-Place Replaceable Detectable Warning Surface Panels (CIP REP) including profile, panel surface profile, plans of panel placement including joints, and material to be used as well as outlining installation materials and procedures.

D. Material Test Reports: Submit all completed current test results from qualified, accredited independent testing laboratories by ASTM and UL/Canada guidelines and indicating that materials proposed for use follow specification requirements and meet or exceed the properties indicated on these specifications.

E. Maintenance Instructions: Submit copies of the manufacturer's specified installation and maintenance practices for each type of Detectable Warning Surface panels and accessories as required.

1.4 QUALITY ASSURANCE

A. Provide Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) and accessories as produced by a single manufacturer with a minimum of five years of experience in manufacturing Cast-In-Place Replaceable Detectable Warning Surface Panels.

B. Installer's Qualifications: Engage an experienced installer certified in writing by Cast-In-Place Replaceable Detectable Warning Surface Panel (CIP REP) manufacturer as qualified for installation, who has completed installations similar in material, design, and extent to that indicated for the Contract.

C. Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) must be compliant with the following guidelines and requirements (applicability may be dependent on project location):

1. American Barriers Act (ABA) Accessibility Standards
2. ADA Accessibility Guidelines (ADAAG)
3. Department of Transportation ADA Standards for Transportation Facilities (2006)
4. Department of Justice ADA Standards (2010)
5. Public Rights-of-Way Accessibility Guidelines (PROWAG)
6. California Building Standards Code, Title 24, California Code of Regulations
7. Texas Accessibility Standards (TAS) 2012
8. AASHTO M 333 Standard Specification for Detectable Warning Surfaces
9. International Code Council (ICC) A117.1 Accessible and Usable Buildings and Facilities

Standard	Standard Description	Value
ASTM D695	Compressive Strength	28,900 psi minimum
ASTM D790	Flexural Strength	29,300 psi minimum
ASTM D 638	Tensile Strength	11,600 psi minimum
ASTM C 1028	Standard Test Method for Determining the Static Coefficient of Friction (Slip Resistance)	1.18 Dry / 1.05 Wet
AS HB198:2014 (AS/NZS 4586)	Pendulum Sustainable Slip Resistance (SSR)	Pendulum Test Value (PTV), with Four S (96) hard rubber slider: 56 Dry / 44 Wet; After 500 cycles of abrasion: 34 Wet
ASTM C501	Abrasion Resistance	Minimum 500

FM 5-594	Abrasion Resistance, Florida Method	Average Volume Loss: no more than 0.03 cm3

D. Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) shall meet or exceed the following test criteria using the most current test methods:

NTPEP TP103 (2015)	High Temperature Thermal Cycling Exposure, (Sect 14) and Resistance to Impact from Falling Tup (Sect 10)	Min. 60 thermal cycles at 200℉ (93.33℃) = maximum damage classification of 'C' at 20 ft-lb impact
ASTM G155	Accelerated Weathering	ΔE<5.0 at 2,000 hours min.
ASTM D570	Water Absorption	0.07%
ASTM C1026	Freeze/Thaw/Heat	No deterioration
ASTM D1037	Freeze/Thaw	No deterioration
ASTM D543	Chemical Stain Resistance	No reaction
ASTM D1308	Chemical Stain Resistance	No reaction
ASTM-B117	Salt and Spray	No change after 200 hours
ASTM E84	Flame Spread Index	20
AASHTO H20	Load Bearing Test	No Damage at 16,000 lbs.

E. Stamped concrete, polymer concrete, concrete pavers/tile, or brick products are not acceptable for use on this project.

1.5 DELIVERY, STORAGE AND HANDLING

A. Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) shall be suitably packaged or crated to prevent damage in shipment and handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect the panel from concrete residue during installation.

B. Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) shall be delivered to a location at the building site for storage before installation. Store panels in an area that is within an acceptable temperature range 40°F - 90°F (4°C - 32°C) and maintain the storage facility in a clean, dry condition to prevent contamination or damage to the panels.

1.6 SITE CONDITIONS

A. Environmental Conditions and Protection: Maintain a minimum temperature of 40°F (4°C) in spaces to receive Cast- In-Place Replaceable Detectable Warning Surface Panels (CIP REP) for at least 24 hours before installation, during installation, and for not less than 24 hours after installation.

B. The use of water for work, cleaning, or dust control, etc. shall be contained and controlled and shall not be allowed to come in to contact with the general public. Provide barricades or screens to protect pedestrians.

1.7 MANUFACTURER'S WARRANTY

A. Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) shall be guaranteed in writing for a period of seven (7) years from date of Contract's final completion. The guarantee includes manufacturing defects, breakage, and deformation.

1.8 INSTALLATION WARRANTY

A. Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) installation

shall be warranted in writing for two (2) years by the installer. Products must be guaranteed from defective work and loosening of panels.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) by ADA Solutions, 323 Andover Street, Suite 3, Wilmington, MA 01887. Toll-Free: 800-372-0519, sales@adatile.com, www.adatile.com.

B. Panel Sizes

1. Standard Rectangular Panels

a. 24” x 24” (609.6 x 609.6 mm)
b. 24” x 36” (609.6 x 914.4 mm)
c. 24” x 48” (609.6 x 1219.2 mm)
d. 24” x 60” (609.6 x 1524.0 mm)

2. Heavy Duty Rectangular Panels, 0.375” (9.5 mm) top thickness

a. 24” x 24” (609.6 x 609.6 mm)
b. 24” x 36” (609.6 x 914.4 mm)
c. 24” x 48” (609.6 x 1219.2 mm)
d. 24” x 60” (609.6 x 1524.0 mm)
e. 36” x 48” (914.4 x 1219.2 mm)
f. 36” x 60” (914.4 x 1524.0 mm)

3. Radius Panels

a. 24” x 33.25” (609.6 x 844.5 mm)
b. Radius options between 6 feet (1.82 m) and 21 feet (6.40 m)

C. Existing engineered and field-tested products, which have been in successful service for five (5) years are subject to specification compliance, may be incorporated in the project and shall meet or exceed the specified test criteria and characteristics. Requests for Approved Equal status must be submitted and approved by the Owner before the Tender Phase of the project.

2.2 MATERIALS

A. Composition: Cast-In-Place Replaceable Detectable Warning Surface Panels (CIP REP) shall be manufactured using a matte finish exterior grade homogeneous (uniform color throughout thickness of product) glass and carbon reinforced polyester based Sheet Molding Compound (SMC) composite material. Truncated domes must contain fiberglass reinforcement within the truncated dome for superior structural integrity and impact resistance. A matte finish will be required on the Tactile Warning Surface for superior slip resistance performance superior to that offered by a gloss finish. Use of Tactile Warning Surface Products employing coatings or featuring layers of material with differing composition, performance, or color properties is expressly prohibited under this Section.

B. Color: Color shall be single, homogeneous color throughout panel

1. Federal Yellow (Y), Federal Standard Color No. 33538
2. Brick Red (R), Federal Standard Color No. 20109
3. Clay Red (CR) Federal Standard Color No. 22144
4. Safety Red (SR) Federal Standard No. 31350
5. Black (B) Federal Standard Color No. 37038
6. Dark Gray (G) Federal Standard Color No. 36118
7. Safety Blue (B) Federal Standard Color No. 15187
8. White (W) Federal Standard Color No 27925
9. Seattle Yellow (SY) Federal Standard Color No. 23594

C. Domes: Raised truncated domes of 0.2” (5.0 mm) nominal height, base diameter of 0.9” (22.8 mm) and top diameter of 0.45” (11.4 mm). ADA Standards and Public Rights-of-Way Accessibility Guidelines require truncated dome spacing range of 1.6”-2.4” (40.6-60.9 mm).
[Designer Note: For superior wheelchair, walker and shopping cart mobility, the preferred truncated dome spacing shall have a center-to-center (horizontally and vertically) spacing of nominal 2.35” (59.6 mm), measured between the most adjacent domes on square grid.]

D. Dome Spacing:

1. Standard Rectangular Panels: 2.35” (59.6 mm) or 2.4” (60.9 mm) dome spacing in square grid pattern
2. Heavy Duty Rectangular Panels: 2.35” (59.6 mm) dome spacing in square grid pattern
3. Radius Panels: 1.67” to 2.4” (40.6-60.9 mm) dome spacing in radial pattern

E. CIP REP panels shall feature a minimum of eight (8) corrosion resistant concrete anchor inserts minimum 1.5” (38.1 mm) long with 0.5” (12.7 mm) x 1.5” (38.1 mm) long corrosion resistance bolts. Anchor bolts locations must be covered with structural water-tight caps. Anchor locations shall not be at truncated domes locations.

F. CIP REP panels shall include a perimeter structural flange minimum 0.70” in depth with gaps to prevent air entrapment.

G. Truncated Dome Surface of CIP REP panels shall be protected with factory installed plastic sheeting for cleanliness during the installation process. Basic Installation Guidelines shall be printed on the plastic sheeting in both English and Spanish for customer convenience.

H. Cleaning materials used on site shall have code acceptable low VOC solvent content and low flammability.

I. The Specifications of the concrete, sealants and related materials shall be in accordance with the Contract Documents and the guidelines set by their respective manufacturers.

SECTION 3 – EXECUTION

3.1 PREPARATION

A. During all concrete pouring and CIP REP panel installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The physical characteristics of the concrete shall be consistent with the Contract

Specifications while maintaining a slump range of 4 - 7 to permit solid placement of the CIP REP panel. An overly wet mix will cause the panel to float. Under these conditions, suitable weights such as 2 concrete blocks or sandbags (25 pounds) shall be placed on each panel.

C. The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to CIP REP panel placement.

3.2 EQUIPMENT

A. Contractor shall provide all tools, equipment, and services required for satisfactory installation per manufacturer's instruction as Incidental Work. Equipment which may be required include typical mason's tools, a 4-foot level with electronic slope readout, 25 lb. (11.4 kg) weights, vibrator, rubber mallet with 2" x 4" x 10" (51 mm x 102 mm x 254 mm) wood tamping plate, and a device for cutting the Detectable Warning Surface Panels.

3.3 INSTALLATION

A. Contractor will not be allowed to install CIP REP panels until all submittals have been reviewed and approved by the Engineer. Panels shall be installed per manufacturer's instructions.

B. To the maximum extent possible, the CIP REP panels shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple panels regardless of size are used, the truncated domes shall be aligned between the panels and throughout the entire tactile warning surface installation.

C. In accordance with the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way 2011, panels shall be located relative to the curb line as shown within Sections 304 and 305 of the Guidelines.

D. CIP REP panels shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the panel is flush to the adjacent concrete surface or as the Drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

E. Cutting and Setting of CIP REP panels shall be cut into size and configuration indicated on the Drawings using a 60 tooth carbide blade on a table saw or equivalent cutting device. Minimize any cantilever effect (to the maximum extent practicable) when cutting between successive embedment ribs as concrete will tend to flow up and over the panels. The top of the body of the panel shall be fully seated and flush with the adjacent concrete substrate. For specific instructions for cutting and setting refer to Detectable Warning Surface manufacturer's written instructions.

3.4 CLEANING AND PROTECTING

A. Protect CIP REP panels against damage during construction period to comply with panel manufacturer's Specifications.

B. During and after the CIP REP panel installation and the concrete curing stage, it is imperative that there are no walking, leaning or external forces placed on the panel to rock the panel, causing a void between the underside of the panel and the concrete.

C. Remove Protective Plastic Sheeting from CIP REP panel within 24 hours of

installation of the panel. Particularly under hot weather conditions (80 degrees or higher), plastic sheeting will adhere strongly (resulting in difficult removal of same) to Detectable Warning Surface panel when not removed quickly.

D. If requested by the Project Manager, clean CIP REP panels not more than four (4) days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean panel by method specified by Detectable Warning Surface panel manufacturer.

END OF SECTION

SECTION 32 8423 UNDERGROUND SPRINKLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

A. Furnishing and installing a complete irrigation system.

B. Trenching and backfill.

C. Connecting and conforming to existing sprinkler systems (if applicable).

D. Inspections and tests.

1.3 RELATED SECTIONS:

A. Section 32 9000 – Planting

B. Section 32 9223 – Grass Sodding

1.4 INTENT OF THE DRAWINGS

A. Irrigation lines shown on the drawings are essentially diagrammatic. Locations of all emission devices, valves, piping, wiring, etc., shall be established by the Contractor at the time of construction.

1.5 QUALITY ASSURANCE

A. Requirements of regulatory agencies:

1. All work and materials shall be in full accordance with the latest rules and regulations of safety orders of Division of Industrial Safety; The Uniform Plumbing Code and other applicable laws or regulations, including the local plumbing code.

2. Nothing in these Drawings and Specifications is to be construed to permit work not conforming to these codes. Should the Contract Documents be at variance with the aforementioned rules and regulations, notify Landscape Architect and get instructions before proceeding with the work affected.

B. Testing:

1. Preliminary review of the completed installation will be made by the Landscape Architect prior to backfilling of trenches and during hydrostatic testing.

2. Final review shall be made in conjunction with the final review of shrub and tree planting.

1.6 SUBMITTALS

A. Furnish required copies of manufacturer's literature, certifications, and operating instruction for the complete list of materials for the following items:

1. Irrigation Controller
2. Backflow Prevention Devices
3. Gate Valves
4. Pipe and Fittings
5. Automatic Control Valves
6. Valve Boxes
7. Quick Coupling Valves
8. Pop-up and Rotor Sprinklers
9. Irrigation Control Wire and Splicing Materials
10. Drip emitters, and other emission devices, if part of system

B. Substitutions:

1. Specific reference to manufacturer's names and products specified in this Section are used as standards, but this implies no right to substitute other material or methods without written approval of the Landscape Architect.

2. Installation of any approved substitution is Contractor's responsibility. Any changes required for installation of an approved substitution must be made to the satisfaction of the Landscape Architect and without additional cost to the Owner.

3. Approval by the Landscape Architect of substituted equipment and/or dimensional drawings does not waive these requirements.

C. Record Irrigation Drawings - Contractor shall furnish Record Drawings of the complete irrigation system in accordance with the General and Special Conditions. Procure from the Landscape Architect full-sized bond copies of the Contract Drawings. Construction drawings shall be on the construction site at all times while the irrigation system is being installed. Contractor shall make a daily record of all work installed each day. Actual location of valves and quick-couplers and all irrigation and drainage piping shall be shown on the prints by dimensions from easily identified permanent features, such as buildings, curbs, walks, fences or property lines. Drawings shall show approved substitutions, if any, of material including manufacturer's name and catalog number. The drawings shall be to scale and all indications shall be neat. All information on the print shall be transferred to the bond copy by the Contractor and all indications shall be recorded in a neat, orderly way. The record drawing shall be turned over to the Landscape Architect at or before the Final Acceptance of the project.

D. Irrigation Contractor shall provide on site instructions to the person(s) responsible for the day to day operations of the irrigation system. At this time, the irrigation Contractor will present this person(s) with all items listed in A, as well as as-built drawings, and a watering schedule guideline which illustrates each valve number and length of operation time.

1.7 JOB CONDITIONS

A. Contractor shall acquaint himself with all site conditions. Should utilities or other work not shown on the plans be found during excavations Contractor shall promptly notify Landscape Architect for instructions as to further action. Failure to do so will make the Contractor liable for any and all damage thereto arising from his operations subsequent to the discovery of such utilities not shown on plans.

B. Contractor shall take necessary precautions to protect site conditions. Should damage be incurred, this Contractor shall repair damage to it original condition or furnish and install equal replacement at his expense.

C. General Contractor shall provide all sleeves and conduits shown on the Drawings. Water meter(s) and electrical power to the irrigation controller(s) shall be provided by the General Contractor. Refer to the Drawings for locations.

1.8 FINAL ACCEPTANCE

A. Work under this Section will be accepted by the Landscape Architect upon satisfactory completion of all work. Upon Final Acceptance, Contractor assumes responsibility for maintenance of the work. In accordance with Section 02840, said assumption does not relieve Contractor of obligations under Warranty.

1.9 WARRANTY

A. In addition to the manufacturer's guarantees and warranties, all work shall be warranted for one year from the date of Final Acceptance against defects in material, equipment and workmanship by Contractor. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defects in materials, equipment and workmanship to the satisfaction of the Owner.

B. Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, etc., during Guarantee Period. Report such conditions to Landscape Architect in writing.

1.10 CLEAN UP

A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during installation operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials throughout the system shall be as specified and/or noted on the Drawings, new and in perfect condition.

2.2 PIPE

A. Mainline piping, two (2") inch diameter and smaller shall be polyvinyl chloride (PVC), Schedule 40 solvent weld pipe with integral solvent weld bells and shall conform to ASTM D-1785, cell classification 12454-B type 1, grade 1.

B. Lateral piping shall be polyvinylchloride (PVC), Schedule 40 solvent weld pipe with integral solvent weld bells, sized per plan, and shall conform to ASTM D-1785, cell classification 12454-B type 1, grade 1.

C. Identification - All PVC piping shall be continuously and permanently marked with the following:

Manufacturers name or trademark, size, schedule or class, and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (N.S.F.) approval.

2.3 FITTINGS

A. Fittings for solvent welded pipe:

1. Schedule 40, polyvinyl chloride, standard weight, as manufactured by 'Spears', 'Lasco', or approved equal, to meet ASTM D-2466-73 and D-2467-73.

2. Threaded PVC nipples - Schedule 80 PVC, ASTM D2464. Molded PVC nipples will not be accepted.

3. Use industrial grade solvent welding cement ANSI/ASTM D2564.

4. All pipe and fittings shall be the product of 1 manufacturer.

B. Fittings for Polyethylene Pipe (Flex-Joints)

1. Polyallomer as manufactured by 'Flintkote' or approved equal.

2. Compression type of CPVC and manufactured by ‘Pepco’ or approved equal.

C. Fittings for Swing Joints:

1. Supply three (3) Schedule 40 ‘Marlex’ elbows.

2. Threaded PVC nipples - Schedule 80 PVC.

D. Drip fittings: As shown on detail drawings.

2.4 GATE VALVES

A. Up to three (3") inch size - Class 125 threaded bronze gate valve rated at 200 psi WOG non-rising stem with bronze cross handle or bronze hand-wheel as indicated on the irrigation drawings or details. The valves shall be Nibco #T113IRR Series or approved equal.

2.5 SLEEVE FOR CONTROL WIRE AND WATER LINE

A. PVC 1126-1220, Schedule 40 PVC pipe.

2.6 IRRIGATION CONTROLLER

A. Location, brand and model number shall be as shown on the Drawings.

2.7 AUTOMATIC CONTROL VALVES

A. Valve shall be of size and manufacturer as shown on the Drawings.

2.8 VALVE KEYS

A. Champion #30 - thirty (30") inches long; Thompson #419, or equal, to fit system valves. Furnish two keys.

2.9 CONTROL WIRE

A. Wire - Stranded copper wire, U.L. approved for direct burial in ground. Minimum gauge: #14 U (#12 U for runs over 1,000 lf). Common ground wire shall be white.

B. Splicing Materials - Scotchlock Spring Connector, 'Scotchlock' #3576 Sealing Pack, or approved equal.

2.10 VALVE BOXES

A. All valve boxes shall be HDPE plastic for the valve box body, extension and lid. Box shall provide adequate clearance to operate and service valve. Box and lid to be tan/beige in non-turf area; green in turf area; or purple/violet for systems using effluent water, as manufactured by Applied Engineering Products, or approved qual.

B. Automatic Control Valve - valve box shall be rectangular, approximately seventeen (17") inches by thirty (30") inches inside dimensions by eighteen (18") inches deep with 8” extensions as needed. Box shall be 1730-18 as manufactured by Applied Engineering Products, or approved equal.

C. Air Release Valves - valve box shall be rectangular, approximately seventeen (17") inches by thirty (30") inches inside dimensions by eighteen (18") inches deep with 8” extensions as needed. Box shall be 1730-18 as manufactured by Applied Engineering Products, or approved equal.

D. Gate Valves, Quick Coupler Valves and Drain Valve Access - valve box shall be round, approximately ten (10") inches inside diameter by ten (10") inches deep, with green bolt-down lid. Box shall be Series 910 L (10" Round) as manufactured by Applied Engineering Products, or approved equal.

2.11 QUICK COUPLING VALVES

A. Valve and key shall be as shown in Irrigation Legend on the Drawings.

B. Furnish two valve keys fitted with three-quarter (3/4") inch swivel hose ells.

2.12 SPRINKLERS

A. Sprinklers shall be as shown in Irrigation Legend on the Drawings.

B. All sprinklers to be of commercial quality.

2.123 DRIP EMISSION DEVICES

A. Emission devices shall be Rain Bird Xeri-Bug Emitters (or approved equal).

1. Xeri-Bug (or approved equal) emitters shall be pressure compensating over the pressure range of 15 to 50 psi and have a consistent flow rate over this pressure range (see valve schedules for flow rates).

2. The emitters shall be self-flushing to minimize clogging.

3. The emitters shall be made of UV resistant acetyl externally.

4. The emitters shall be color-coded on the inlet side to identify flow rate. A blue inlet shall indicate a flow rate of 0.5 gallons per hour, a black inlet shall indicate a flow rate of 1.0 gallons per hour and a red inlet shall indicate a flow rate of 2.0 gallons per hour.

2.14 IDENTIFICATION MATERIALS AND WARNING TAPE

A. Valve Number Identification Tags: Each automatic valve shall have a station identification tag attached to the solenoid or flow control handle made from polyurethane plastic with the numbering permanently hot stamped into the tag. The tag shall be yellow in color and accommodate up to three 1 1/8” alphanumeric characters per side. The tags shall be manufactured by T. Christy Enterprises or approved equal.

B. Warning Tape For Electrical Wiring: Warning tape for 115 volt or higher electric wiring voltages installed in trenches shall be 3” wide, non-detectable plastic tape manufactured from 4-mil thick low-density polyethylene meeting ASTM standards D882 and D671. The warning tape shall be red in color and continuously labeled every 3 feet “Caution Electric Line Below.” The tape shall be Christy’s #TA-ND-3-RE for electrical wire installations, or approved equal.

C. Warning Tape For Mainline Pipe Installation: All warning tape for mainline pipe installation shall be 3” wide, non-detectable plastic tape manufactured from 4-mil thick low-density polyethylene meeting ASTM standards D882 and D671. The warning tape used for irrigation mainline warning protection shall be green in color and continuously labeled every 3 feet “Caution Irrigation Line Buried Below.” The tape shall be Christy’s #TA-ND-3-BI for irrigation mainline installations or approved equal.

2.15 BACKFLOW PREVENTER

A. Backflow preventer shall be bronze body, as shown on the plans, in accordance with manufacturer's latest printed instructions, 12" minimum above all downstream piping and emitters, and in heated enclosure per plan.

PART 3 - EXECUTION

3.1 LAYOUT

A. No consideration will be given to any design changes until after awarding of the contract. Should any changes be deemed necessary after award of contract, for proper installation and operation of the system, such changes shall be negotiated by the Landscape Architect (and based on the Unit Price Schedule where applicable).

B. Layout work as accurately as possible to drawings. Drawings are diagrammatic to the extent that emitters, swing joints, offsets and all fittings are not shown.

C. Full and complete coverage is required. Contractor shall make any necessary minor adjustments to layout required to achieve full coverage of irrigated areas at no additional cost to the Owner.

D. Where connections to existing stub-outs are required, make necessary adjustments should stubs be located differently in the Drawings. Adjust layout as necessary to install around existing work.

E. Where piping is shown to be under paved areas but running adjacent and parallel to planted area, the intent is to install piping in planted areas. Do not install directly over another line in the same trench.

F. It shall be the Contractor's responsibility to establish the location of all emission devices in planting areas in order to assure proper coverage of all areas. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger sizes may be approved. All pipe damaged or rejected because of defects shall be removed from site at the time of said rejection.

G. The Contractor will stake out the location of each run of pipe, drip emitter locations and valve locations prior to trenching. Before installation is started in a given area, the Landscape Architect shall check all locations and give his approval.

3.2 EXCAVATION AND TRENCHING

A. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations, to their original condition. If excavation or trench must be left open for a reasonable amount of time, the Contractor shall provide for proper marking, roping and barricades in accordance with OSHA standards.

B. Should utilities not shown on the plan be found during excavations, Contractor shall promptly notify the Landscape Architect for instruction as to further actions. Failure to do so will make the Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities. Indicate such utility crossings on the Record Drawings promptly.

C. Dig trenches true to line and wide enough to allow a minimum of four (4") inches between parallel pipe lines. Trenches shall be free of rubbish and large stones and of sufficient depth to provide minimum cover from finish grade as follows:

1. 30 inches over mainline pipe.
2. 18 inches over lateral pipe.
3. Trenches shall be sloped to drain valves where applicable, and avoiding ground surface deviations to avoid air pockets and low collection points in the line.

D. Should existing paving require cutting, saw cut paving a minimum twelve (12") inches wide, compact to backfill to 95% dry density. Dispose of waste offsite. Patch to match existing pavement.

3.3 BORING UNDER EXISTING PAVEMENTS

A. The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation shall be described under "Excavating and Trenching". The location of the pit shall not interfere with existing plant materials or structures designated to remain.

B. Holes shall be bored mechanically. Where holes required are larger than two (2") inches, the bore shall be completed using a pilot hole. The two (2") inch hole shall be bored the entire length of the

crossing and shall be checked on the opposite end for line and grade. If acceptable, this hole shall serve as the center line for the larger hole to be bored. Lateral and vertical tolerance is limited to one (1") inch in ten (10') feet, provided that the variation be regular and occur in only one direction.

C. The use of water and other fluids in connection with the boring operation will be permitted only to lubricate cutting. Jetting shall not be permitted.(In unconsolidated soil formations, a gel-forming collodial drilling fluid consisting of at least ten (10%) percent of high-grade processed bentonite may be used to consolidate cuttings, seal the hole walls and furnish lubrication for subsequent removal of cuttings and installation of pipe.)

D. Excavated material will be placed near the top of the working pit and disposed of as required.

E. Refer to other authorities for jurisdiction over other installations.

3.4 CONDUITS AND SLEEVES

A. General Contractor to supply all conduits and sleeves.

B. Coordinate conduit and sleeve installation with other trades as required.

3.5 PIPE LINE ASSEMBLY

A. General:

1. Install pipes and fittings in accordance with manufacturer’s latest printed instructions.
2. Clean all pipes and fittings of dirt, scales and moisture before assembly.
3. All pipe, fittings and valves, etc., shall be carefully placed in trenches. Interior of pipes shall be kept free from dirt and debris when pipe laying is not in progress. Open ends of pipe shall be closed by approved means.

B. Solvent-Welded Joints for PVC Pipes:

1. Use primer on all solvent welds.
2. Use solvents and methods by pipe manufacturer.
3. Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty four hours before placing the joint under water pressure.

C. Threaded Joints for Plastic Pipes:

1. Use Teflon tape on the threaded PVC fittings except where Marlex fittings are used.
2. Use strap-type friction wrench only. Do not use metal-jawed wrench.
3. When connection is plastic to metal, male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon tape or equal upon approval.

D. Joints for Polyethylene Pipes:

1. Double-clamp all connections one and one-quarter (1-1/4") inch diameter and greater.
2. Make all connections between polyethylene pipes and metal valves or pipes with threaded fittings using male adapters.

E. Laying of Pipe:

1. Pipes shall be bedded in at least two (2") inches of finely divided material with no rocks or clods over one (1") inch diameter to provide a uniform bedding.
2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe in the minimum allowance for snaking.
3. Do not lay PVC pipe when there is water in the trench.
4. Plastic pipe shall be installed in a manner as to provide for expansion and contraction as recommended by the manufacturer.
5. Plastic pipe shall be cut with PVC pipe cutters or a hacksaw, or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth, unobstructed flow will be obtained.

6. All plastic to plastic joints shall be solvent-welded joints or slip-seal joints. Only the solvent recommended by the pipe manufacturer shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.
7. Unless waived by the Landscape Architect, the Contractor shall install bell type or approved slip joint fitting at a minimum of twenty (20') feet OC for all pressurized mains.
8. Mainline Piping and Fitting Restraints: All mainline tees, ells and caps shall have pipe to fitting or valve to fitting joint restraints installed. All mainline and submain / lateral piping isolation valves shall have pipe to valve restraints installed. All valves must be restrained to fittings, all pipe must be restrained to valves and all piping installed directly into mainline fittings must be restrained. Acceptable fittings and restraint systems are Leemco and Harco and "megalug" type restraints for mechanical joint fittings. The installation of these restraints does not negate the need for thrust blocking as described previously.
9. Warning Tape Installation: The appropriate specified warning tape shall be installed 9" deep in all mainline trenches; trenches that contain 120 volt or higher voltages and mainlines or submain piping that carry effluent or reclaimed water.

3.6 GATE VALVES

A. Group valves together and locate in planted areas where possible. Box shall be flush with finish grade. For three (3") inch or larger rubber-gasketed pipe, anchor valve with a thrust block per manufacturer's instructions. Boxes shall be set level and plumb, free of external debris and dirt.

3.7 AUTOMATIC CONTROL VALVES

A. Install control valves in valve boxes where shown and group together where practical. Place no closer than twelve (12") inches to walk edges, buildings and walls. Valve boxes shall be flush with finish grade.

3.8 EMISSION DEVICES

A. Place all rotary pop-up sprinkler heads in lawn areas on temporary risers with top of heads four (4") inches above finish grade. Place part-circle rotary pop-up sprinkler heads twelve (12") inches from edge of and flush with the top of adjacent walks, header boards, curbs, and mowing bands, or paved areas at time of installation. Rotary sprinklers to be installed on a swing joint assembly as detailed.

B. Drip Emission Devices – install per details provided in the plans.

3.9 QUICK COUPLING VALVES

A. Quick coupling valves shall be installed on a swing joint assembly as detailed on the Drawings.

3.10 AUTOMATIC CONTROLLER

A. Install per local code and manufacturer's latest printed instructions.

B. Connect automatic control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.

C. Affix controller name (i.e., "Controller A") on inside of controller cabinet doors with letters minimum of one (1") inch high. Affix a non-fading copy of irrigation diagram to cabinet door below controller name. Irrigation diagram to be sealed between two sheets of 20 mil (minimum) plastic. Irrigation diagram shall be a reduced copy of the as-built drawing and shall show clearly all valves operated by the controller, showing station number, valve size, and type of planting irrigated.

D. Install controller at location directed by the Architect, run low voltage irrigation wire to controller.

3.11 CONTROL WIRING

A. Install control wires with sprinkler mains and laterals in common trenches wherever possible. Lay to the side of pipe line. Provide looped slack at valves and snake wires in trench to allow for contraction of wires. Tie wires in bundles at ten (10') foot intervals. Lay 24 volt wiring and 120 volt wiring on opposite sides of pipe.

B. Control wire splices at automatic control valves to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of 500 feet or more. Line splices to be mariconi-type taped and sealed with Scotchkote sealer.

C. Install a minimum of one (1) extra control wire to control valve located the greatest distance from the controller in both directions and label each end blank.

3.12 CLOSING OFF PIPE AND FLUSHING OF LINES

A. Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal in necessity for completion of installation.

B. Thoroughly flush out all water lines before installing heads, valves and other hydrants.

C. Test as specified.

D. Upon completion of testing, complete assembly and adjust sprinkler heads for proper distribution.

E. All sprinkler heads and quick coupling valves shall be set perpendicular to finished grades unless otherwise designated on the Drawings, or otherwise specified. Sprinkler heads adjacent to existing walls, curbs and other paved areas shall be set to grade. Sprinkler heads which are to be installed in lawn areas where the turf has not yet been established shall be set one (1") inch above proposed finish grade. Heads installed in this manner will be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. Such lowering of heads shall be done by this Contractor as part of the original contract with no additional cost to the Owner.

3.13 TESTING

A. Perform testing of PVC pipe after sufficient time has been allowed for solvent weld joints to cure (24 hour minimum).

1. Visual Inspection and 4 Hour Static Pressure Test: Upon completion of a particular section of the irrigation system, the piping system shall be hydrostatically tested by capping off all sprinkler head risers, swing joints, etc.. Prior to capping, all air and dirt shall be flushed from the system and the pipe partially back-filled, leaving all joints, risers, swing joints and connections exposed for visual inspection. If “O”-ring gasket pipe or fittings were used in the installation, thrust blocks must be in place and cured. Pressurize system to 150 psi for mainline and 100 psi for laterals lines. If after four (4) hours for mainline, and 1 hour for lateral lines, no visual leakage has occurred, the heads shall be installed and the back-fill operation completed.

2. Any leaks resulting from the hydrostatic test shall be repaired and the system retested until the system passes the test.

B. Submit written requests for inspections to the Landscape Architect at least forty eight (48) hours prior to anticipated inspection date.

3.14 BACKFILL AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of debris.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 95% density under pavements, 90% under planted areas.

C. Compact trenches in areas to be planted by thoroughly flooding the backfill. Jetting process may be used in those areas.

D. Dress off all areas to finish grades.

3.15 “AS-BUILT” SYSTEM DRAWING RECORD

A. Irrigation System As-Built Records – Contractor Responsibility

1. System Drawing: The Contractor shall keep an up-to-date set of “as built” drawings which shall be corrected and updated daily to show all changes in the location of sprinkler heads, bubblers, controllers, backflow preventers, valves, drains, meters, air release valves, point of connections, wire splice points, pipe and wire routing and any other changes that may have been made from the final construction drawings and specifications as provided to him. The Contractor shall supply two hardcopy plots of the as-built irrigation system plotted on the same size sheet and layout as provided in the construction drawings, as well as one digital copy in AutoCAD format, Release 2000 or higher.

2. Reduced Size Laminated “As-Built” Irrigation System Drawing: The Contractor shall provide two full color, water proof, laminated “as-built” irrigation drawings on 17” X 11” sheets that contain the complete irrigation system as-built information.

3.16 GUARANTEE

A. The Contractor shall warrant all materials and workmanship for one (1) year from date of written Final Acceptance by Landscape Architect.

3.7 CLEAN-UP

A. Clean up and remove all debris from the entire work area prior to Final Acceptance to satisfaction of the Landscape Architect.

END OF SECTION 32 8423

SECTION 32 9000 PLANTING

PART 1 - GENERAL

1.01 SCOPE:

A. Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to complete installation of the planting, and guarantee/warranty as shown on the drawings and as specified herein. Items of work specifically included are:

a. Procurement of all applicable licenses, permits, and fees.

b. Soil preparation.

c. Planting Operations

d. Fine grading of all planting areas.

e. Construction maintenance period.

1.02 RELATED WORK:

A. Division 2 - Site Work:

a. Section 32 8423 – Underground Sprinklers

1.03 QUALITY ASSURANCE:

A. Contractor Qualifications: All work specified herein shall be performed by a landscape contractor experienced with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily.

B. Source Quality Control:

A. Compliance with Laws - All plant materials shall comply with State and Federal Laws, including the New Mexico Plant Protection Act, with respect to inspection for disease infestation.

B. Tagging of Trees - The Contractor shall submit to the Owner's Representative, at least one week in advance of tagging date, an itemized list of trees along with a notice as to where and when the nursery inspection of trees shall be made. The accepted trees will be tagged by the Owner's Representative for delivery to the site.

C. Plant Inspection of all plant materials will be made for size, vigor, representiveness of species and variety, injury, condition of ball and roots, or latent defects. Inspection at delivery does not preclude the possibility of rejection of material after installation.

D. Substitutions of equivalent varieties of plant materials or other materials may be permitted only with the approval of the Owner's Representative. Requests for substitutions along with an appropriate price or quantity adjustment shall be submitted to the Owner's Representative for approval. Written approval from the Owner's Representative will be required before substituting materials.

E. Analysis and Standards - All packaged standard products shall have manufacturer's certified analysis.

1.3 SUBMITTALS:

A. Submit samples under provisions of Section 01330 - Submittals.

B. Materials List: Submit for plant materials, mulches, and soil amendments and include sources.

1.04 HANDLING AND STORAGE:

A. Protect all materials used for construction from damage, deterioration, or loss of any kind while in storage and during construction.

B. Store plant materials and protect from drying. Provide shade for sun sensitive plants. Handle balled and container stock only by root ball or container.

1.05 REVIEWS:

A. A review will be performed at substantial completion of all planting operations under this section, and construction maintenance period will begin at time of substantial completion.

B. Final review will be performed at the end of the construction maintenance period.

1.06 ENVIRONMENTAL CONDITIONS:

A. Plants shall be planted only when weather and soil conditions permit, and in accordance with locally accepted practices, and as reviewed by the Owner's Representative.

1.07 GUARANTEE/WARRANTY AND REPLACEMENT:

A. Guarantee/warranty trees, shrubs, ground covers, and other landscape materials against defects due to any cause for a period of one year from the date of substantial completion and the commencement of the formal construction maintenance period.

B. This guarantee/warranty will not be enforced should the plant die due to vandalism; improper maintenance procedures carried out by the Owner involving over and under watering, lawn mower damage, over fertilization, non-removal of guy lines causing girdling of the trunk; fire, flood, or hail; or other similar circumstances beyond the control of the Contractor.

C. Replace landscape materials and trees, shrubs, ground covers, and when they are no longer in a satisfactory condition as determined by the Owner's Representative for the duration of the Guarantee/Warranty Period. Make replacements within fourteen days of notification from the Owner's Representative. Remove dead plants within seven days of notification.

D. All replacements shall be of the same kind and size as originally specified and shall be installed as described in the contract documents. Repairs and replacements shall be made at no expense to the Owner.

E. Guarantee/warranty shall apply to originally specified and installed plants and other landscape materials, and any replacement material made during the guarantee/warranty period.

PART 2 - MATERIALS

2.01 QUALITY:

A. All materials used for construction shall be new and without flaws or defects of any type, and shall be the best of their class and kind.

2.02 SOIL AMENDMENTS/FERTILIZERS/MULCHES:

A. Topsoil: Excavated soil for use as backfill mix.
B. Nature's Bio T/S Planting Mix (Polymer Mix), as available from Organic Technology, 13170-B Central Ave SE #118, Albuquerque, NM 87123, (505) 291-1100.
C. Nature's Bio F/M-Plus (Fish Mix), as available from Organic Technology, 13170-B Central Ave SE #118, Albuquerque, NM 87123, (505) 291-1100.

2.03 WATER:

A. Available on site through the use of irrigation system. Coordinate needs for irrigation water with Irrigation Contractor.

2.04 PLANT MATERIALS LIST:

A. Plant list, if shown, is provided for information only. Provide plants in the quantities as shown on the drawings, despite any discrepancies with quantities called for in the plant list.

2.05 TREES, SHRUBS, AND GROUND COVERS:

A. Plant Materials shall be first-class representative of its species; healthy, well branched, and well proportioned in respect to height and width relationships; free from disease, injury, insects, and weed roots.

B. Botanic and Common Names given in the plant list are in conformance with standard horticultural practice in the area. Plants are to be delivered to the site with tags bearing the botanic name as indicated by the plant list.

C. Digging, Wrapping, and Handling: Plants shall be dug and prepared for shipment in a manner that will not cause damage to branches, shape, and future development after planting:

1. Balled and burlapped plants shall be nursery grown stock adequately balled with firm, natural balls of soil in sizes and ratios conforming to the codes and standards of the AAN. Balls shall be firmly wrapped with non-treated burlap, secured with wire or jute. Broken

balls will not be accepted.

2. Container grown plants shall have been nursery grown in containers and shall have sufficient root to hold the entire soil mass together after container removal without being root-bound.

3. Options as to method: If all other requirements are met, a balled and burlapped plant may be substituted for a container grown plant or field collected plant.

D. Plant Protection: Plants shall be handled so that roots are adequately protected at all times from drying out and from other injury. Protect balls of balled plants which cannot be planted within twelve hours of delivery with soil or other suitable material. Where possible, store plants in the shade. Keep all plant roots moist before, during, and after planting.

2.6 FILTER FABRIC:

A. Shall be DeWitt Pro-5 Weed Barrier - 5 oz. needle punched polypropylene fabric, or approved equal.

2.07 ROCK MULCH:

A. Rock Mulch – shall be from a single source and free from all foreign objects. Mulch shall be as specified on the planting plan.

PART 3 - EXECUTION

3.01 INSPECTIONS AND REVIEWS:

A. Site Inspection and Review:

1. Verify site conditions and note irregularities affecting work of this section. Report irregularities to the Owner’s Representative prior to beginning work.

2. Beginning work of this section implies acceptance of existing conditions.

B. Pre-Planting Review:

1. Owner’s Representative will review plant material before planting. Materials planted prior to review are subject to rejection. Reviews of materials may be sequenced by major planting areas to accommodate efficient planting operations. All rejected materials must be removed from the site, replaced, and replacements reviewed before planting.

2. If, in the opinion of the Owner’s Representative there is probable cause to suspect root damage, root binding, or disease conditions in the container stock plants, the Landscape Contractor will remove the container for the Owner’s Representative's review before planting.

C. Planting Review: The Owner’s Representative will review the staked location of trees before digging commences. Notify Owner’s Representative after staking and 24 hours prior to review.

D. Verify locations of underground utilities.

E. Verify fine grading is complete and accepted by the Owner, and is within two inches at all edges of curbs, walks, and pavement.

3.02 SITE PREPARATION:

A. Clearing: Prior to any soil preparation, existing vegetation not to remain and which might interfere with the specified soil preparation shall be mowed, grubbed, raked, and the debris removed from the site. Prior to or during grading or tillage operations, the ground surface shall be cleared of materials which might hinder final operations.

3.03 TREE AND SHRUB PLANTING:

A. Established Location: Stake tree and shrub locations as shown on the plans. Receive review of Owner’s Representative prior to installation. Any plant material planted prior to this review is subject to removal of relocation at no additional expense to the Owner.

B. Planting Pits:

1. Dig planting pits to the sizes shown in the appropriate planting detail.

2. Roughen sides of the pit to remove any compacting or glazing. Loosen soil at bottom of

pit to a minimum depth of six inches. Mix loosened soil with specified backfill.

C. Backfill Material:

1. Trees – Incorporate 7 lbs. of Nature's Bio T/S Planting Mix per caliper inch size, or 1 lb. per gallon size container into soil excavated from planting pit.
2. Shrubs - Incorporate 1.5 lbs. of Nature's Bio T/S Planting Mix per 1 gallon size container, or 4 lbs. per 5 gallon size container into soil excavated from planting pit.

D. The specified backfill materials shall be pre-mixed using a Royer soil grinder or other industry accepted technique in order to obtain a uniform, evenly blended consistency, free from pockets of unblended material and clods or stones greater than two inches in diameter. Backfill mix shall be delivered to each planting pit after mixing has occurred.

E. Planting:

1. Remove stock from container. Do not break the root ball. A spade shall not be used. Scarify sides and bottom of root ball.
2. Place backfill mix into planting pit to depth such that the plant rootball when planted, will be flush with finish grade.
3. Untie and remove burlap from top third of root ball on balled and burlapped material. Remove wire baskets from top and sides of root ball.
4. Backfill one-half of pit with backfill mixture and water in thoroughly before placing any more backfill. Do not work wet soil.
5. Backfill the rest of the planting pit with backfill mixture and tamp to compact.
6. Apply Nature's Bio F/M Plus at a rate of 2 oz. per I gallon size container and 6 oz. per gallon size container per manufacturer's recommendations.
7. Ensure that all trees and shrubs are set and remain in a true vertical position during the planting operations.

3.05 MULCHING:

A. Rock Mulch: Mulch all shrub and groundcover areas with rock mulch as specified on the plans. Rake and level rock mulch material to desired finish. Finished surface of rock mulch shall be ¾" below level of adjacent concrete areas.

3.6 PROTECTION AND CLEANING:

A. During the installation and maintenance periods, protect planted areas against erosion and trespass. Any damaged planting shall be replaced by the Contractor at no additional cost to the Owner.

B. All walks and pavements shall be swept or washed clean upon completion of work in each area. Upon completion of all planting work, clean that portion of the site used for storing plant materials and equipment of all debris, extra materials, and equipment.

3.7 MAINTENANCE PERIOD:

A. Begin maintenance of plants immediately after planting.

B. Maintain trees and shrubs for a period of three (3) months beyond final acceptance by Owner of all contract work.

C. Maintenance Activities: Maintenance shall include measures necessary to establish and maintain plants in a vigorous and healthy growing condition:

1. Maintain water basin around plants of adequate size to maintain moisture throughout the root zone. When hand watering, use a water wand to break the water force.
2. Fall planted trees shall not be pruned until one year after planting, except to remove broken or weak branches.
3. Keep planting areas, gravel beds, etc., free of weeds. Use recommended, legally approved herbicides, or remove weeds by hand. Avoid frequent soil cultivation that destroys shallow roots. Weed at least once per week.

4. Maintain reasonable insect and disease control with approved materials to prevent visual and structural damage to the plants.
5. Fertilization with RAPID-GRO or equal shall occur at the suggested rate, once per month during the growing season.
6. Remove dead and dying plants and replace with plants of an equal size, condition, and variety of original planting plan. Replacements shall be made at no expense to Owner.
7. Remove trash, clipped grass, and blown dirt weekly from shrub beds, lawns, walks, and tree basins. Keep the entire area within the limits of planting free from trash and dirt (water or wind carried) at all times. Repair erosion damage for duration of maintenance period.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.01 SCOPE:

A. The work under this section consists of revegetation with seeded grasses. contractor shall furnish all labor, materials, equipment, tools, and transportation required to complete the work, and shall perform all operations in connection with and reasonably incidental to establishing, maintaining, and warranting the reseeded areas.

B. All work shall be completed in accordance with these specifications, the drawings and contract documents, and in a manner consistent with accepted horticultural practices. All permits, licenses, and fees associated with any work under this contract are the responsibility of contractor, unless otherwise noted.

1.02 RELATED WORK:

A. Division 2 - Site Work:

1. Section 32 93 00 Planting

1.03 REFERENCES:

A. The following is a list of standards which may be referenced in this section:

1. Association of Official Seed Analysts (AOSA).

1.04 SUBMITTALS:

A. Contractor shall be required to submit statements of guarantee and/or certifications from vendors who supply seed, mulches, tackifiers, and fertilizers.

B. Contractor shall furnish to architect a signed statement certifying that the seed furnished is from a lot that has been tested by a recognized laboratory for seed testing within six (6) months prior to the date of delivery.

C. Seed container labels shall be submitted to architect at the completion of project.

D. Contractor shall submit to architect the manufacturers guaranteed chemical analysis, name, trade name, trademark, and conformance to state law of all fertilizers and herbicides.

E. Submit compost sample for approval.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. All materials shall be furnished in original manufacturers shipping bags or containers and remain in these bags or containers until they are used. All materials shall be stored in a manner that will prevent them from coming into contact with precipitation, surface water, or any other contaminating substance.

B. Fertilizer: It shall be delivered in original, unopened containers, unless provisions are made and approved by architect for bulk deliveries to the site of the work.

C. Herbicide: It shall be delivered in original, unopened containers, unless provisions are made and approved by architect for bulk deliveries to the site of the work. All

herbicides will be stored in a manner that satisfies local, State and Federal Guidelines for Herbicide Storage.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. All materials shall be furnished in original manufacturers shipping bags or containers and remain in these bags or containers until they are used. All materials shall be stored in a manner that will prevent them from coming into contact with precipitation, surface water, or any other contaminating substance.

B. Fertilizer: It shall be delivered in original, unopened containers, unless provisions are made and approved by architect for bulk deliveries to the site of the work.

C. Herbicide: It shall be delivered in original, unopened containers, unless provisions are made and approved by architect for bulk deliveries to the site of the work. All herbicides will be stored in a manner that satisfies local, State and Federal Guidelines for Herbicide Storage.

PART 2 MATERIALS

2.01 GENERAL:

A. All materials used shall be new and without flaws or defects of any type and shall be the best of their class and kind. Seeds shall be prepared for sale during the year of installation.

B. All materials and equipment furnished shall be free of noxious weeds including, but not limited to Russian knapweed, diffuse knapweed, Canada thistle, field bindweed, Johnsongrass, leafy spurge, kochia, or any state-listed noxious weed species.

C. Any materials that have become wet, moldy, or otherwise damaged in transit or in storage shall not be used.

2.02 SEED:

A. Seed shall be only that which is specified by landscape architect (refer to drawings). All seed shall be mixed by a wholesale seed supplier in order to obtain the specified mixture and application rate required by landscape architect. No species substitutions shall be permitted without prior approval of the landscape architect.

B. All seed shall conform to all current State and Federal regulations and shall be subject to the testing provisions of the Association of Official Seed Analysts.

C. All seed and seed mixes shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the common, scientific, and variety name(s) of the seed(s), the lot number, point of origin, net weight, percent of weed content, and the guaranteed percentage of purity and germination

D. All seed shall be guaranteed for purity and germination, free of noxious weed seed and supplied on a Pure Live Seed (PLS) basis.

2.01 HYDROMULCH:

A. The type of mulching material to be used shall be plant derived mulches such as wood or paper mulch. At least seventy percent (70%) of the mulch by weight shall be ten (10) inches or more in length. Mulch shall not contain any noxious weed, must, mold, cake, or decay.

2.02 ORGANIC TACKIFIER/BINDER:

A. Organic tackifier/binder shall be organic plant derived tackifier materials

2.03 WATER:

A. All water used on the project shall be free of any substances harmful to plant germination and growth or to the environment in general. contractor shall be responsible for furnishing and applying water that meets these requirements. Landscape architect may, at contractor's expense, submit samples of water used on the PROJECT for laboratory analysis (of a reasonable number and kind) to ensure the quality of the water. Onsite water shall not be used unless approved by owner or owners representative.

2.04 ORGANIC COMPOST (SOIL AMENDMENT) (if specified on drawings):

A. For use as a component for seed establishment use a well decomposed, stable, weed free organic matter source, derived from agricultural food, yard trimmings, or source-separated or mixed solid waste. The product shall contain no substances toxic to plants and shall be reasonably free (less than one percent [<1%] by dry weight) of man-made foreign matter. Compost shall be processed at sustained high heat so that any weed seeds contained within it shall no longer be viable and it shall possess no objectionable odors and shall not resemble the raw material from which it was derived.

B. Compost shall have the following characteristics:

1. pH Range: 5.5 - 8.0.
2. Moisture Content: 35% - 55%.
3. Particle Size: Pass through 1-inch screen or smaller.
4. Stability: Stable to highly stable, providing nutrients for plant growth.
5. Maturity/Growth Screening: Demonstrate ability to enhance plant growth.
6. Soluble Salt Concentrations: 2.5 dS (mmhos/cm) or less preferred.
7. Organic Matter Content: 30% - 70%.

PART 3 EXECUTION

3.01 GENERAL:

A. Contractor's Site Responsibilities: It shall be the responsibility of contractor to locate and protect all utilities, structures, roadways, parking areas, fences, survey markers, and existing vegetation (such as, trees and shrubs) on all work sites. Any damage caused by contractor or subcontractors shall be immediately repaired or corrected by contractor at no expense to owner.

B. Timing of the Work: Seeding shall occur between September 15 and April 15, unless otherwise permitted by the architect.

C. Notice to Proceed: contractor shall inform architect when they are ready to commence permanent revegetation. Upon agreement with contractor's preparation for this work architect shall provide contractor with a Notice to Proceed. contractor shall begin and complete the WORK as specified in this section.

D. Performance of the work: All work is to be performed by personnel thoroughly familiar with proper and accepted methods for soil preparation, herbicide applications, fertilizing, seeding, and mulching. All work is to be performed under the direct supervision of contractor's superintendent, who shall be thoroughly familiar with the provisions of this contract.

3.02 SOIL/SEEDBED PREPARATION, SOIL AMENDMENTS:

A. All ripping and tilling operations shall be done in a direction which follows the natural contour of the land on slopes of three to one (3:1) or less. Soils on slopes greater than three to one (3:1) shall be prepared for planting in a manner specified by ARCHITECT. Any irregularities in the ground surface resulting from soil preparation operations shall be corrected and sloped to drain.

B. Limit subgrade preparation to areas that shall be planted in the immediate future.

C. Prior to spreading salvaged topsoil and seeding, thoroughly till or rip to a depth of twelve (12) inches all areas compacted by access, staging, or construction traffic. Till all remaining areas to a depth of six (6) inches. Channel bottom areas are to be ripped to a depth of at least twelve (12) inches on approximately two- (2-) to four- (4-) foot centers. The soils shall be worked until no clods greater than two (2) inches in diameter remain, unless directed otherwise by ARCHITECT. Remove rocks and other objects three (3) inches or greater in any dimension.

D. Spread topsoil to depth required to meet grades and elevations shown on DRAWINGS after light rolling and natural settlement.

E. Either mix soils with soil amendments and fertilizers before spreading or apply soil amendments or fertilizers on surface of spread topsoil and till thoroughly into top four (4) inches before planting. Mix soil amendments at the rate that is indicated on the DRAWINGS. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.

F. Organic Compost:

1. Organic Compost Soil Amendment shall be applied at a rate of three (3) cubic yards per one-thousand (1,000) square feet or as shown on the DRAWINGS.

2. Organic Compost shall only be applied if required and designated on the DRAWINGS.

G. Prior to seeding, grade the areas to be seeded to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Soils shall meet grades and elevations shown on DRAWINGS after light rolling and natural settlement. Limit fine grading to areas that can be planted in the immediate future.

H. Moisten prepared areas to be seeded prior to planting when soils are dry. Water thoroughly and allow surface to dry before seeding. Do not create muddy conditions. Restore prepared areas if eroded or disturbed after fine grading and before planting.

3.03 SEEDING

A. General: architect shall be on site during seeding operations and will collect representative samples of the seed used on any PROJECT for testing/compliance purposes. contractor shall notify architect when seeding is to take place so these samples can be obtained (seed tags from all mixtures shall also be supplied to the architect).

B. Drill Seeding:

1. All seed is to be drilled one-quarter (1/4) inch to one-half (1/2) inch into the soil at the specified pure live seed (PLS) per acre rate with a mechanical grass drill with depth bands and an agitator in the seed box. Rows shall be spaced not more than seven (7) inches apart. Contractor shall drill one-half (1/2) of the required PLS per acre in one compass direction, and then drill the remaining half of the required PLS per acre in a direction ninety degrees (90°) to the first half.

C. Broadcast Seeding:

1. Broadcast seeding is an acceptable method of seeding on slopes over 4:1 that are inaccessible to drill seeding equipment. Seed shall be uniformly broadcast at twice the specified PLS per acre and covered with soil to a depth of one-quarter (1/4) inch to one-half (1/2) inch by hand raking.

2. Broadcast seeding shall be accomplished using hand-operated “cyclone-type” seeders or rotary broadcast equipment attached to construction or revegetation machinery. All machinery shall be equipped with metering devices. Broadcasting by hand shall be acceptable on small, isolated sites. Prior to hand broadcast seeding, divide the seed required into two portions. Apply the first half of the seed and then follow up by applying the second portion to ensure complete coverage by seed. When broadcast seeding, passes shall be made over each site to be seeded in a manner to ensure an even distribution of seed. When using hopper type equipment, seed shall be frequently mixed within the hopper to discourage seed settling and uneven planting distribution of species.

3. Broadcast seeding shall take place immediately following the completion of final seedbed preparation techniques and upon inspection and approval of architect. Broadcast seeding should not be conducted when wind velocities would prohibit even seed distribution.

3.04 HYDROMULCHING

A. Hydromulching shall be applied immediately after seeding has been completed with at a rate not less than one and one-half (1-1/2) tons per acre, and not more than two (2) tons per acre. Straw mulch shall then be anchored to the soil with a standard commercial crimper which shall crimp the fiber four (4) inches or more into the soil. Failure to apply designated mulch at the specified rate may result in the architect requiring the contractor to remobilize and complete the specified work at no additional cost to the owner.

3.05 FIELD QUALITY CONTROL

A. Final Acceptance:

1. When WORK has been completed for the project, contractor and architect shall inspect the site together and determine the total area of the work, and whether or not the WORK is complete and has been done in accordance with contract documents and specifications. If mutual agreement cannot be reached on these issues, the determinations made by architect shall be final. Deficiencies in the WORK, if any, shall be noted and a checklist of these deficiencies given to contractor by architect. contractor shall immediately correct any deficiencies listed on the checklist at no cost to owner.

2. When all checklist items are completed to the satisfaction of architect, architect shall issue a Certificate of Final Acceptance. contractor shall then submit these items for payment to owner based on the original project BID prices and any change orders which have been agreed to and signed by both parties.

3.06 CLEANING

A. All work sites shall be kept clean and free from all debris. At the conclusion of work at any site, contractor shall remove and haul from the site all excess materials, debris, and equipment. Any damage (for example, damaged fencing, damaged road surfaces, excessive tire furrows, mud tracked onto pavement) resulting from contractor's activities shall be repaired by contractor to architect's satisfaction at no expense to owner.

END OF SECTION

SECTION 40 00 00 PROCESS INTEGRATION INDEX

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Special Conditions and the General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Furnish all service tools, equipment, etc., which are required for the complete installation of all Process Integration Work, as indicated on the Drawings and specified herein. Process Integration work indicated on the Drawings and/or specifications covering other trades shall conform to Division 40 of these Specifications.

B. Work or equipment not indicated or specified, which is necessary for the complete and proper operation of the Process Integration systems shall be accomplished without additional cost to the Owner.

C. Furnish all labor and materials required for Process Integration service connections to all the various items of equipment requiring electric or wiring service throughout the project shown on the Contract Drawings (even if not shown on Process Integration Drawings). Coordinate with other trades for the installation of required connections and service.

1.3 PROCESS INTEGRATION DIVISION INDEX

40 05 04	PROCESS PIPING

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

--- THIS PAGE INTENTIONALLY BLANK ---

SECTION 40 05 04 PROCESS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General requirements for tube, pipe, piping components, materials, fittings, valves, flanges, and installation of process piping systems applicable to ASME B31.3.
   1. Category Normal Fluid Service:
      a. Process Vacuum (Dry and Wet Vacuum)
   2. Category D Fluid Service:
      a. Specialty Gas: Oxygen gases below 150 psig and between -20 degrees F and 366 degrees F.

1.2 RELATED SECTIONS

DIVISION 07	FIRESTOPPING
01 25 00	SUBSTITUTION PROCEDURES
01 33 00	SUBMITTAL PROCEDURES
22 05 00	GENERAL PLUMBING REQUIREMENTS
22 07 00	PIPING INSULATION
22 10 00	PIPE AND PIPE FITTINGS
23 05 48	VIBRATION ISOLATION AND EXPANSION COMPENSATION

1.3 REFERENCES

A. ASCE 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures

B. ASME B1.1-2024, Unified Inch Screw Threads (UN, UNR and UNJ Thread Forms)

C. ASME B1.20.1-2013(R2018), Pipe Threads, General Purpose (Inch)

D. ASME B16.5-2020, Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard

E. ASME B16.9-2018, Factory-Made Wrought Buttwelding Fittings

F. ASME B16.18-2021, Cast Copper Alloy Solder Joint Pressure Fittings

G. ASME B16.20-2023, Metallic Gaskets for Pipe Flanges

H. ASME B16.21-2021, Nonmetallic Flat Gaskets for Pipe Flanges

I. ASME B16.22-2021, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

J. ASME B16.24-2021, Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500

K. ASME B16.25-2022, Buttwelding Ends

L. ASME B16.34-2020, Valves-Flanged, Threaded, and Welding End

M. ASME B16.39-2020, Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

N. ASME B18.2.1-2012 (R2021), Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

O. ASME B18.2.2-2022, Nuts for General Applications: Machine Screw Nuts; and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

P. ASME B18.21.1-2009(R2016), Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

Q. ASME B31.3-2022, Process Piping

R. ASME BPVC Section IX-2023, Qualification standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators

S. ASTM A53/A53M-2016, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

T. ASTM A307-2007b, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength

U. ASTM A563/A563M-2007a, Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric)

V. ASTM B68-2002/B68M-1999 (R2005) Standard Specification for Seamless Copper Tube, Bright Annealed

W. ASTM B75-2002/B75M-1999 (R2005) Standard Specification for Seamless Copper Tube

X. ASTM B88-2003/B88M-2005, Standard Specification for Seamless Copper Water Tube

Y. ASTM B280-2008, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

Z. ASTM F436/F436M-2002(R2009), Standard Specification for Hardened Steel Washers

AA. B31.3 Code Cases 2014

BB. CGA P-23, Standard for Categorizing Gas Mixtures Containing Flammable and Nonflammable Components (not listed)

CC. MSS SP-25-2018, Standard Marking System for Valves, Fittings, Flanges, and Unions

DD. MSS SP-72-2010a, Ball Valves with Flanged or Butt-Welding Ends for General Service

EE. NMAC, New Mexico Administrative Code

1.4 SUBMITTALS

A. Submit the following in accordance with Section 01 3300, Submittal Procedures.

B. Action Submittals
   1. Catalog data on pipe materials, fittings, valves, and accessories. Include the Manufacturer's name, model number, parts list, and brief description of equipment and its basic operational features.
   2. Before fabrication, submit:
      a. Proof of journeyman certificate of competence in accordance with NMAC 14.6.6.11

C. Informational Submittals at Closeout
   1. Spare Parts and Maintenance Materials list
   2. Installation, Operation, & Maintenance Manual
   3. Warranties
   4. Manufacturer's data report form for ASME pressure vessels (e.g., ASME Form U-1) showing National Board registration

1.5 QUALITY ASSURANCE

A. Material and Installation: Conform to ASME B31.3 for Category D, and Normal Fluid Services.

B. Valve Identification: Each valve shall bear markings in accordance with MSS SP-25, including manufacturer's name or trademark, the material of construction, and symbols to indicate the service conditions for which the manufacturer rates the valve.

C. Design pressure and temperature of piping systems within this Section is provided in the Pressure Safety Implementation Plan, contained in drawings and Contract Documents.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted per Section 01 2500, Substitution Procedures and 01 4115, Pressure Safety Submittals.

B. Proposal of unlisted components as substituted components is strongly discouraged and shall be evaluated per Section 01 2500, Substitution Procedures. Substitutions will be allowed only if the Subcontractor can demonstrate that the product can meet the same code requirements of the item specified in the design. Costs associated with evaluation of substituted unlisted components shall be the responsibility of the Subcontractor.

2.2 PIPING/TUBING/FITTINGS

A. Copper tubing ASTM B68, ASTM B88

1. Braze Joints
   a. Fittings: ASME B16.22, wrought copper and copper alloy, solder-joint pressure fittings [and/or] ASME B16.18 cast-copper-alloy solder-joint pressure-fittings
   b. Unions: Copper Tube and Pipe: ASME B16.22, Class 150, bronze unions with soldered joints.
   c. Comply with Welding, Brazing, and Soldering of ASME B31 Piping.
2. Solder joints
   a. Fittings: ASME B16.22, Wrought Copper and Copper Alloy, Solder-Joint Pressure Fittings [And/Or] ASME B16.18 Cast-Copper-Alloy Solder-Joint Pressure-Fittings.
3. Fluid Service: Category D
4. System Application(s): Inert laboratory gas less than 150 psig and between -20 degrees F and 366 degrees F.
5. Location: Above grade.
6. Size: as shown on Contract Documents.

2.3 FLEXIBLE CONNECTORS

A. Manufacturer: Global Passive Safety Systems Lifeguard, Hose and U.S. Hose Corporation 402X with Spring Guard
   1. Material: compatible with oxygen system
   2. Working-Pressure Rating: 150 psig minimum
   3. End Connections: MNPT ASME B1.20.1, Threaded
   4. Fluid Service: Category Normal, D
   5. System Application(s): system less than 150 psig and between -20 degrees F and 366 degrees F.
   6. Location: Above grade
   7. Assembly Methods: screwed
   8. Size: as required by Contract Documents

2.4 FLEXIBLE HOSE RESTRAINTS

A. Manufacturer: Hubbell or approved equal
   1. Model: Kellems ® Universal Eye
   2. Material: Stainless steel 302-304T
   3. Size: 0.5 to 3.99 inches

2.5 STRAINERS

A. Manufacturer: Pelmar Engineering Ltd. or approved equal
   1. Example Part Number: IFC Series Y150SST (threaded)
   2. Description: One piece cast A351-CF8M Stainless Steel Body, 304SS screen, ASTM A182-316 plug, Teflon gasket, ½ inch size, 0.032-inch screen opening
   3. Rating: 275 psig non shock, 200 psig at 400 degrees F, sizes: [1/2 inch - 3 inch]
   4. Fluid Service: Normal
   5. Location: Above grade
   6. Assembly Methods: socket welded, ASME B1.20.1 NPT

2.6 DIELECTRIC CONNECTIONS

A. Threaded/Soldered

1. Manufacturer: Watts
2. Model: 3001A
3. Description: ASME B16.39 union female iron pipe thread per ASME B1.20.1 to copper solder joint
4. Rating: 250 psig at 180 degrees F
5. Size: 1/2 inch to 2 inch
6. Fluid Service: Category D
7. System Application(s): Vacuum
8. Location: Above grade
9. Assembly Methods: ASME B1.20.1 NPT, braze, solder

PART 3 - EXECUTION

3.1 PREPARATION

A. Square, ream pipe and tube ends. Remove burrs.

B. Cleaning:
1. Remove scale and dirt on inside and outside before assembly.
2. Cleaning will consist of removing all non-adhering material such as loose scale, sand, weld spatter particles, rust, cutting chips, grinding residue, etc. from the inside of the piping assembly by suitable means. This level of cleaning will allow the presence of mill scale and surface rust.

C. Prepare piping connections to equipment with flanges or unions.

D. Fastener materials shall be free of nicks, burrs, chips, dirt, and damage (inspect threads, shank, and nuts). All damaged fasteners must be replaced.

3.2 INSTALLATION

A. General
1. Install piping in conformance with ASME B31.3.
2. Welding, brazing, or soldering shall be in accordance with ASME B31.
3. Weld/braze joints shall meet the approved WPS/BPS joint requirements.
4. Label piping system in accordance with Section 22 1000 Pipe and Pipe Fittings.
5. Insulate piping system in accordance with Section 22 0700 Piping Insulation. Provide clearance for installation of insulation and access to valves and fittings.
6. Support piping system in accordance with Section 22 0500 General Plumbing Requirements. Do not anchor the pipe. Allow piping to slide and expand or contract with temperature.
7. Sleeve and caulk pipes penetrating exterior walls or interior bearing walls. Provide waterproof installation for exterior walls. Provide UL/FM approved through-penetration firestop system when penetrating fire rated barriers (e.g., walls, floors, etc.). See Division 07. Install chrome-plated steel escutcheons where pipes are not insulated in finished areas.
8. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
9. For multiple openings in piping mains, the distance between their centers shall be at least the sum of their inside diameters.
10. Branch connections shall utilize fittings (tee, lateral, or cross) in accordance with listed codes.
11. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Matching of bronze with steel or copper does not require dielectrics.
12. Install piping to maintain headroom and neither interfere with use of space nor take more space than necessary. Piping shall not block access to manholes, access covers, etc.
13. Group piping whenever practical at common elevations.
14. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
15. All valves shall be installed in accordance with the manufacturer's instructions and with sufficient clearance and access for ease of operation and maintenance. Install valves with stems upright or horizontal, not inverted.
16. Install pressure gauges vertically.
17. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction, protect open ends with temporary plugs, caps, or residue-free tape.
18. Install flexible connections for equipment where shown on drawings.

B. Fabrication
1. Piping shall be fabricated in accordance with the provided Contract Documents.
2. No pipe or tube bends are allowed. Fittings are to be used instead of bends.

C. Erection
   1. Install all piping shown on the construction drawings per manufacturer's recommended procedures and this Section.
   2. Deviations from locations identified on the drawings must be approved by Engineer and documented for incorporation into as-built drawings.
   3. Wedges shall not be used to laterally contain or position pipe for closure fit-ups.
   4. Flanged dielectric connections shall be installed with dielectric bolt insulators.
   5. Drain piping shall slope downward in the direction of flow. The minimum slope or grade indicated on design documents shall be maintained regardless of other installation tolerance. If low points cannot be avoided on pressurized lines, a ball valve the same size as the line with a threaded plug in the outlet shall be provided at the low point.
   6. Identification and/or traceability marks of piping components shall not be removed or hidden by surface treatment, coating, or subdividing during installation unless other identification methods are implemented to ensure that all markings are properly transferred, and traceability documentation is maintained for the components. Installer must verify that items are correct for the installation and have legible identification markings.
   7. Threaded Joints:
      a. Compound or lubricant used on bolt threads shall be suitable for the service conditions and shall not react unfavorably with either the service fluid or the piping material. Refer to manufacturer's recommendations for suitable compounds and lubricants. Lubricant for stainless steel shall contain no chloride.
      b. Provide non-conducting dielectric connections whenever joining dissimilar metals in liquid systems with corrosion potential.
      c. The threaded joint assembly shall be in accordance with ASME B1.20.1 paragraph 3.1.9 Wrench-Tight Engagement between External and Internal Taper Threads.
      d. No more than six and no less than two threads visible after makeup of the joint.
         1) No severe chipping or tearing of visible threads.

3.3 EXAMINATION, INSPECTION, AND TESTING

A. For the purposes of this Section, the Subcontractor is responsible for all tasks identified as examination and testing.

B. All welding, brazing and soldering: Inspected, examined, and tested in accordance with Welding, Brazing, and Soldering of ASME B31 Piping

C. Externally the pressure system will be free of weld slag, flux, and weld spatter.

D. The fabrication documentation must have evidence of the examination, the evidence must be maintained in the pressure system documentation package submitted to the pressure safety officer.

E. Pipe examinations shall be performed after fabrication, after required heat treatment, and before leak testing.

F. Both the extent of examination and acceptance criteria shall be in accordance with ASME B31.3 paragraph 341 examination and Section A341 examination for non-metallic systems, as applicable.

G. When pneumatic testing is planned 100% of all threaded, bolted, and other mechanical joints shall be examined.

H. Any items rejected because of defects shall be repaired, replaced, and examined per this Section and ASME B31.3.

I. Methods of examination shall be per ASME B31.3 Section 344.

J. Pressure/Leak Testing
   1. Pressure/leak test piping system per Section 22 1000 Pipe and Pipe Fittings.
   2. Vacuum Piping: Evacuate to 1mm Hg (1 Torr or 1000 microns) measured with an electronic manometer or thermocouple gauge. After 2 hours, if vacuum level has risen to no higher than 2.5 mm Hg (2.5 Torr or 2500 microns), the leak test is acceptable.
   3. Piping subject to external pressure shall be tested at 1.5 times the external differential pressure, but not less than 15 psig.
   4. In all cases when testing above design pressure, reduce pressure to design prior to checking for leakage.
   5. Laboratory Gas Piping (Category Normal)

a. Test piping with oil-free, dry cylinder nitrogen at 150 psig +/- per ASME B31.3 paragraph 345.5 Pneumatic Leak Test for at least 120 minutes.

END OF SECTION